

THE EFFECT OF PHYSICAL TEST FORMAT MODIFICATIONS  
ON THE PERFORMANCE OF THIRD GRADE MILDLY HANDICAPPED  
AND NORMAL STUDENTS

BY

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By

Susan Beattie

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Major Department: Special Education

Tests are an integral part of our educational process. In view of Public Law 94-142, The Education for All Handicapped Children Act, it becomes crucial that diagnostic instruments are valid, culturally fair, and unbiased. Caution must be exercised to insure that the targeted behaviors are the ones actually being assessed. Test results should reflect cognitive ability and not the individual's disability.

In an effort to make tests fair to handicapped populations, such modifications as head pointers, braille type, and alterations in administration and setting have been instituted. Little systematic study, however, has been directed towards mildly handicapped students or physical test item format modifications. The current study investigated the effect of five physical format modifications on the performance of mildly handicapped and normal third grade students. The

modifications included alterations in line lengths, inclusion of examples, the use of boldface type for emphasis, placement of answer bubbles, and the arrangement of items in a hierarchy of progressive difficulty. Eighty students were randomly selected from four populations; i.e., normal, learning disabled (LD), emotionally handicapped (EH), and educable mentally retarded (EMR) students. The students were matched within each category according to reading ability and then randomly assigned to either the modified or the standard test group. Data were analyzed at a level of significance of  $\alpha = .05$ .

The results indicated that overall total test scores were significantly higher on the modified test than on the standard test. There were no significant differences between test form scores for four out of five modification subtests. Performance scores on the example subtest however, were significantly higher on the modified version than on the standard test version. Performance scores for emotionally handicapped and LD students were statistically similar as were the scores for normal and EH students. EMR students consistently scored lower than other categories of students.

Results of a post hoc analysis indicated that modifications of physical test format may have some merit in mastery level situations. Mean performance scores on the modified test surpassed mastery criteria for 32 percent of the subskill sections failed by the students taking the standard test.

It appears that simple modifications can be made in minimum competency tests that affect the performance of students. These

modifications appeared to have a greater effect on the performance of handicapped students than on that of normal students. Continued research in the area of minimum competency test modifications appears warranted.

## CHAPTER I

### INTRODUCTION

America spends \$70 billion annually on education, and administers over 250 million tests. As a result of such enormous expenditures of time and money, one may assume that America is a fully literate society. Unfortunately, this appears to be untrue. A congressional survey revealed that 13 percent of our 17-year-old youths are functional illiterates (Pabian, 1979). Another survey published in 1973 by the Department of Health, Education, and Welfare (HEW) supported these data and stated that an estimated one million American youths, between the ages of 12 and 17, can not read at a fourth grade level and can therefore be labeled as illiterate (cited in McClung, 1977). Ysseldyke and Algozzine (1982) cited Copperman's report that America's academic performance and standards have shown a marked decline since the mid-1960's.

Today's eighth grader reads approximately as well as the average seventh grader just ten years ago and computes about as well as the average sixth grader of that period. On college admissions tests only about a quarter of our current high-school graduates attain the level recorded by the average high school graduate in the early 1960's. (Copperman, 1978, p. 15)

Several explanations have been offered in regard to America's educational plight. The National Academy of Education panel has

reported that "there is growing evidence that shifts in policy, expectations, and behavior within schools themselves have contributed to the documented decline in writing skills and aptitude test scores" (Berry, 1979, p. 167). The low performance level in our schools has also been attributed to the amount of on task learning time. According to Berry (1979), students tend to be on task for approximately only 30 percent of the instructional day. The impact of this statistic is magnified when one realizes that only 60-70 percent of the total school day is actually devoted to learning. In addition, there appears to be a decline in the number of students enrolled in core academic subjects and an increase in the number of optional courses available (Berry, 1979; Copperman, 1978).

Public criticism and rigid surveillance of our schools would appear to be justified if students who graduate after 12 years of education are truly unable to read and write. Even with the acknowledgment that there are other variables (such as home, family, and community influences) that do contribute to an individual's achievement potential, it would appear that our schools must still assume the primary responsibility for graduating illiterates (Pinkney, 1979).

#### Current Interest in Minimum Competency Programs

Educators, administrators, legal consultants, parents, and employers have become increasingly concerned about the mastery of skills demonstrated by graduating high school students. This concern has been fostered not only by the previously cited statistics, but also

by the gradual decline in Scholastic Aptitude Test (SAT) scores (Copperman, 1978) and recent litigation in the courts (Donohue v. Copiague Union Free School District, 1978; Peter W. v. San Francisco Unified School District, 1976).

In an effort to reduce illiteracy statistics and eliminate the possibility of future litigation, many educators and concerned members of the community have focused their attention on minimum competency programs. Although the minimum competency testing (MCT) component has drawn the most attention recently, it is but one component of the more global concept of competency based education (CBE).

#### Minimum Competency Testing Within A Competency Based Education Framework

Competency based education (CBE) is comprised of five major components. They include (a) establishment of educational objectives, (b) development of instructional process, (c) competency testing, (d) provision for remedial instruction, and (e) program evaluation and reconceptualization (Watts, 1979). It is suggested that the five components are interdependent and the incorporation of just one or two components would be punitive to any student.

Educators who advocate competency based education foresee a process that will ensure the acquisition of fundamental knowledge. They contend that the attainment of a standard set of skills and abilities can enhance a student's chances for leading a happy and productive life. They argue that if used properly, CBE can also assist in the identification and correction of weaknesses in our educational

system. Possibly, competency based education could facilitate America's effort to reestablish the priority and high esteem of its educational system.

The curriculum objectives and instructional process within CBE are measured by competency testing scores. The competency tests are criterion-referenced and measure a student's performance relative to a specified set of behaviors. They differ from norm-referenced tests in that they do not compare student performance to an established standard. Norm referenced tests discriminate between individuals, whereas criterion referenced tests can be regarded as the best indication of what is being taught in the classroom (Denninger, 1979). The testing distinguishes those students who need additional remedial instruction. It also provides teachers and administrators with feedback on the effectiveness of the teaching methods being employed and the appropriateness of the program.

The goal of competency testing is to improve programs, not to fail students, point an accusing finger at students or teachers, or withhold diplomas. Instead, MCT allows school personnel to document how well a student is prepared to move from grade to grade, and to ascertain those specific skills any high school graduate brings to our working society. This is in contrast to a current trend where the only requirement for graduation is time spent in school and the completion of an established number of courses.

The minimum competency testing movement has received strong support from numerous legislators and state boards of education.

According to Popham (1981) nearly 40 states have established minimum competency testing programs covering the basic skills of reading, writing, and mathematics. Seventeen of those states have also established competency testing as a requirement for high school graduation (Neill, 1979).

### Reactions to Minimum Competency Testing

Positive effects. According to Popham (1981) there are several positive attributes to the MCT program. Pinkney (1979) has identified the positive characteristics specific to Florida's program;

1. Both students and teachers have been provided with a list of exactly which skills are to be mastered by the students and a timetable for accomplishing these objectives. Ideally, the basic skills criteria are decided upon by a diverse group of individuals including teachers, administrators, professors, parents, employers, and other professionals.

2. There has been a renewed interest in learning in school. Cognitive development has returned as the primary justification for the existence of schools. The supplementary frills have been minimized and educating children has become the highest priority.

3. The MCT program has created a new awareness among parents in regard to their children's education. The realization that their children will be required to demonstrate mastery of basic skills at the 3rd, 5th, 8th, and 11th grade has stimulated parents to monitor continual progress.

4. There has been a reorganization and greater utilization of human resources throughout the state based on the needs of the student. Specificity in purpose has contributed to greater efficiency in the performance of teaching personnel. Program planning and education procedures established by administrators have also shown marked improvements.

5. Standardized tests measure students against students. In contrast, MCT measures the mastery of skills. This characteristic can be used to regroup students by skill levels rather than by age, permit report cards to be based on continuums, and allow each student to learn at his/her own pace. If executed with caution, these changes could lessen a student's feeling of failure and enhance the chance of success.

Pabian (1979) noted that in the early 60's, the quality of teaching in the urban ghetto was relatively low, with 40 percent of the high school graduates being classified as functional illiterates. The Pygmalion effect dominated as teachers, observing students having difficulty learning academics, attributed the difficulty to socio-economic factors and stopped trying to teach the impossible. Pinkney (1979) feels the MCT program in Florida has counteracted this Pygmalion effect. He maintains that the teachers' expectation level for students has increased and that the students are working harder to learn.

Negative effects. On the other hand, there are educators who express a concern that MCT will have negative effects on our educational system (Madaus, 1981). Pinkney (1979) addressed the

negative issues which surround MCT; he included the following in his discussion:

1. There is a fear that minimum competencies may become maximum competencies. Critics infer that such advanced courses as Calculus, Chemistry, Literature, and World History may eventually be eliminated from the school curriculum.
2. There is a concern that a concentrated emphasis on basic academic skills may reduce interest in other disciplines, such as music, art, and physical education.
3. There also may be a negative stigma associated with those students requiring remedial classes. As a consequence, some opponents of MCT fear students may become discouraged at the prospect of failing the MCT, and choose to drop out of school.
4. Some educators fear there will be an abusive use of the test results. Improper use of scores can segregate groups of students, contribute to poor self-concepts, and act as a barrier for future employment.

Other individuals are concerned that the MCT movement has been implemented too quickly and without necessary precautions. McClung (1977), an education law consultant and staff attorney for the Center of Law and Education, Inc., has listed several legal and educational issues that may be hazardous to both students and schools. These issues include (a) potential racial discrimination, (b) remediation component (tracking of minorities), (c) technical adequacy of test (instructional and curricular validity), (d) adequate phasing-in

period, (e) MCT as a requirement for graduation, and (f) negligence issues. McClung stresses the fact that these issues are merely potential problems that warrant further inspection and consideration by policy makers.

### Impact of MCT on Handicapped Individuals

The handicapped individual is protected from unfair and discriminatory practices by the Federal Constitution, various statutes, and regulations. The Fourteenth Amendment of the Constitution guarantees all individuals the equal protection of the law. Section 504 of the Vocational Rehabilitation Act of 1973 (P.L. 93-112) prohibits discrimination, denial of benefits, or the exclusion of a handicapped person from an educational program or opportunity solely on the basis of a handicap. The handicapped individual is also protected from unfair educational practices, especially with regard to assessment, by the provisions of Public Law (P.L.) 94-142, The Education for All Handicapped Children Act of 1975 (Abeson & Zettel, 1977). These laws provide a fundamental basis that ensures the right of the handicapped student to participate to his/her maximum ability in any and all educational programs. Any approach a state may adopt to accommodate the handicapped students in MCT must fulfill the requirements of existing legislation.

McClung and Pullin (1978) state there are four areas of legal concern for the handicapped population in the implementation of a minimum competency testing program. These include (a) exemptions,

(b) individualized determinations, (c) differential diplomas and standards, and (d) differential assessment procedures.

Exemptions for handicapped students. The extent to which handicapped students should be required to pass (or be held exempt from) a competency test as a prerequisite to a high school diploma is an important concern in the area of MCT. The National Association of State Directors of Special Education (1979) indicated that of the 17 states currently requiring competency testing prior to high school graduation, 6 require all or selected categories of handicapped students to take the competency test. The remaining 11 states have not specified any policies regarding the handicapped student. These results are congruent with the survey findings of Smith and Jenkins (1980) that the majority of states have not "established or finalized" their positions regarding the inclusion or exclusion of handicapped students from the MCT programs.

Ewing (1979) refers to 11 classifications of handicapped individuals (speech impaired, mentally retarded, deaf, hard of hearing, visually handicapped, seriously emotionally disturbed, orthopedically impaired, other health impaired, deaf-blind, multi-handicapped, and learning disabled) and indicates that the "heterogeneity of the handicapped population prohibits any reasonable expectation that handicapped students be either systematically included or excluded from competency test requirements" (p. 115). For example, it would be difficult to legally justify the exclusion of an academically competent handicapped child from MCT on the basis of physical

confinement to a wheelchair, and yet realistic and fair to exempt a profoundly retarded individual.

Individualized determinations. It would appear that no uniform approach for all handicapped children would be equitable when types and severity of handicapping condition are considered (Denninger, 1979; Ewing, 1979; McClung & Pullin, 1978). For example, any attempt to establish a general policy that would be equitable to both a mildly speech impaired student and a seriously emotionally disturbed individual would appear impossible. As a consequence, it would seem most appropriate that decisions regarding student participation in MCT programs be made on an individual basis. All handicapped students, however, should have the opportunity to participate in the MCT program if they desire, and any school district that fails to provide that option may be in violation of P.L. 93-112 (McClung, 1979). The process of individualized determinations also provides educators with an opportunity to become more aware of the wide range of ability and achievement levels within the handicapped population.

Differential diplomas and standards. Another issue affecting the handicapped population is the awarding of differential diplomas and the establishment of differential standards. McClung (1979) characterizes a differential diploma as being distinguishable in color, shape, or wording from a standard diploma. Differential standards are usually less stringent than the standards required for nonhandicapped students.

McClung and Pullin (1978) again emphasize the need for individualized determinations. School personnel, policy makers, and parents need

to decide which of three general approaches would be best for each handicapped student. Some handicapped students will have no problems complying with standard procedures and obtaining a standard diploma. Other students may need differential standards in order to earn a standard diploma. This could be accomplished by using the student's Individualized Education Plan (IEP) and designing a modified competency program that would meet the special needs and capabilities of the student. Other students may be so severely handicapped that differential diplomas and differential standards would be the most appropriate alternative.

These three options assure handicapped individuals the property right of obtaining the most appropriate diploma. This becomes critical in light of Smith and Jenkins' (1980) warning that issuance of a differential diploma or certificate of attendance could become a source of stigma to a handicapped individual. According to a U.S. Department of Labor report, a high school diploma is required for entry into virtually all jobs (Safer, 1980).

Differential assessment procedures. This final issue has far reaching implications not only for the success of the minimum competency testing movement, but for basic educational principles and legal equality. Many mildly handicapped individuals have, almost by definition, difficulty taking standardized tests (Smith & Jenkins, 1980). How can school personnel effectively measure levels of knowledge when the student's responses may be adversely affected by the instrument used? It is essential that each student's achievement be measured

and not the handicapping condition (Gearheart & Willenberg, 1974; Marsh, Gearheart, & Gearheart, 1978; McCarthy, 1980; Salvia & Ysseldyke, 1978). For example, traditionally most competency testing programs have been restricted to paper and pencil tests. Educators must be able to verify that this type of assessment accurately measures the competencies being taught and fulfills standards of test reliability and validity. Otherwise, it becomes the legal responsibility of policy makers to eliminate potential discrimination against handicapped individuals and devise differential assessment procedures.

#### Test Modifications and Competency Testing

Research concerning test modifications appears to be relatively limited in nature. In addition to a paucity of data based studies, there has also been a tendency to narrowly restrict the target populations to adults, the visually impaired, and the physically handicapped. Traditional test modifications for these students have been braille or enlarged print, the use of a head pointer, or an aide to transcribe answers.

Test modifications for the mildly handicapped student have typically been "procedural" or environmental in nature. Examples of such modifications include a reduction in group size, a change in administrative setting, or a waiver of time limits. Researchers are now, however, becoming aware of the possible need to modify the actual test itself. This has been demonstrated through the modifications of the minimum competency tests administered in New Jersey and

Florida. Examples of such modifications include print size, audio support, grouping of test items in a progressive hierarchy, methods for recording answers, adaptations in line length, inclusion of examples, and realistic representations.

### Statement of the Problem

There is much controversy regarding the educational practice of minimum competency testing. Frequently debated issues for the normal students include legal ramifications, minority rights, comparability of curricula, and implementation procedures. For handicapped learners, however, there are additional problems that may take precedence over these basic issues. The performance of handicapped and non-handicapped students will likely be different; it is assumed that the difference is due to the students' handicaps and not the circumstances of testing. However, failure to consider possible sources of performance differences (other than student abilities) may be a major source of bias in assessment. Such factors as inappropriate test construction or item selection, as well as problems in the general testing procedures, may contribute to poor performance of the exceptional child and the inaccurate assessment of his/her fundamental content knowledge.

### Purpose

The purpose of this study was to investigate the effect of physical test construction modifications on the performance of third grade mildly handicapped (learning disabled, educable mentally retarded,

and emotionally handicapped) and normal students. The effects of five modifications were measured within the three groups of mildly handicapped students and one group of nonhandicapped learners.

The independent variables in this study were type of student and test type. Students were characterized as normal, learning disabled (LD), emotionally handicapped (EH), or educable mentally retarded (EMR); criteria used for determination of such mildly handicapping conditions as LD, EH, and EMR are listed in Appendix A. Tests comprised of standard and modified formats were used; the modifications included: (a) the grouping of similar items in a hierarchy of progressive difficulty, (b) the arrangement of line lengths in an unjustified manner, (c) the introduction of examples and directions for each new skill change, (d) the placement of answer bubbles to the right of each foil, and (e) the use of boldface type for emphasis. The dependent variable in this study was the raw score indicating the student's performance on the total test or selected items.

### Related Questions

This study was designed to investigate the effects of physical test construction modifications on the performance of selected elementary school aged children. Specifically, the following questions were addressed:

1. What effect does test item modification have on the total test performance of mildly handicapped and normal children?
2. What effect does the grouping of similar items in a hierarchy of progressive difficulty have on the test performance of mildly handicapped children and the performance of normal children?

3. What effect do unjustified line lengths have on the test performance of mildly handicapped children and the performance of normal children?

4. What effect does the introduction of examples and directions for each new skill change have on the test performance of mildly handicapped children and the performance of normal children?

5. What effect does placement of answer bubbles to the right side of foils have on the test performance of mildly handicapped children and the performance of normal children?

6. What effect does the use of boldface type have on test performance of mildly handicapped children and the performance of normal children?

### Limitations

This study included third grade mildly handicapped and regular classroom students from Alachua County and Orange County School Systems in north-central and central Florida, respectively. The handicapped students were identified as learning disabled (LD), educable mentally retarded (EMR), and emotionally handicapped (EH) according to the regulations of the Florida State Department of Education (see Appendix A). As a result of variations in identification criteria between states, the handicapped students in this study may not be representative of other handicapped students throughout the United States. Likewise, educational and cultural differences due to geographic factors may also affect the representativeness of both handicapped and regular classroom students in this study.

### Delimitations

The delimitations of this study included (a) the use of third grade students and (b) the county regulations and criteria that were used to identify and classify the randomly selected sample of normal and handicapped (LD, EH, EMR) students. Additional delimitations were that the participants were enrolled in selected elementary public schools from the cities of Gainesville and Orlando, Florida. The Gainesville schools included Duval, Stephen Foster, Lake Forest, Prairie View, M.K. Rawlings, Archer, Shell, and Metcalfe elementary schools. Participating schools from the city of Orlando were Pine Hills, Ridgewood Park, Hiawassee, Blankner, Cherokee, Fern Creek, Lake Como, Chickasaw, Eccleston, and Lake Weston.

The cities of Gainesville and Orlando are located in Alachua County and Orange County, respectively. The sample population was representative of the southeastern region of the United States, specifically north-central and central Florida. A final delimitation of this study was that the test was a paper and pencil task measuring a limited sample of behaviors. These behaviors included the knowledge of fractions, measurement, coin value, picture sequencing, alphabetical ordering, and math word problems in the example subtest; reading comprehension (not, end, pronouns), word opposites, and following directions in the boldface type subtest; two digit addition, math word problems, reading comprehension, and spelling in the answer bubble subtest; vertical and horizontal addition and

and subtraction of single and two digit numbers in the hierarchy subtest; and reading comprehension, money word problems, and number word problems in the altered line length subtest.

### Definition of Terms

Boldface type is darkened print that draws attention to itself and can be used for items requiring additional emphasis.

The educable mentally retarded (EMR) student is one who is mildly impaired in intellectual and adaptive behavior and whose development reflects a reduced rate of learning. The measured intelligence of an educable mentally retarded student generally falls between two and three standard deviations below the mean, and the assessed adaptive behavior falls below age and cultural expectations (Florida Department of Education, 1979).

The emotionally handicapped (EH) student is one who, after receiving supportive educational assistance and counseling services available to all students, still exhibits persistent and consistent severe behavioral disabilities which consequently disrupt the student's own learning process. This is the student whose inability to achieve adequate academic progress or satisfactory interpersonal relationships cannot be attributed primarily to physical, sensory, or intellectual deficits (Florida Department of Education, 1979).

The learning disabled (LD) student is one who exhibits a disorder in one or more of the basic psychological processes involved in the understanding or in using spoken and written language. These may be manifested in disorders of listening, thinking, reading,

talking, writing, spelling, or arithmetic. They do not include learning problems which are primarily due to visual, hearing, or motor handicaps, to mental retardation, to emotional disturbance, or to an environmental deprivation (Florida Department of Education, 1979).

The normal student is one who appears to be functioning within normal limits in the classroom and is not eligible for additional educational services.

Unjustified lines are created by the arrangement of type and uniform spacing so that lines are set according to their natural length. This is opposed to justified line lengths where alterations in spacing cause every line to end at the same distance from the right-hand edge of the paper. Justified lines are traditionally found in textbooks, newspapers, and magazines.

### Summary

Testing appears to be an inescapable phenomenon in today's educational system. Each year over 250 million standardized tests are administered to America's 44 million school children (Ysseldyke & Algozzine, 1982). The positive benefits to be gained from testing include provision of additional educational support services, appropriate educational placement, and curriculum modifications. Unfortunately, tests can also have negative implications. Inaccurate assessments or interpretations can result in misdiagnosis, inappropriate placement, and inefficient instructional goals and techniques.

Some of these negative results may be due to the unintentional measurement of a child's inability to respond to the stimulus-

response format. In such instances the test results may not accurately represent the child's cognitive proficiency in the various skill areas. Instead, they may represent the inability to handle the "standard" stimulus-response testing format.

The purpose of this study was to investigate the effects of physical test format modifications on the performance of mildly handicapped (LD, EH, EMR) and normal students in the third grade. The modifications included alterations in line length, grouping of similar items in a hierarchy of progressive difficulty, an increased ratio of examples per skill change, placement of answer bubbles, and the use of boldface type for emphasis. It was anticipated that these test modifications would result in differential performance scores.

## CHAPTER II

### REVIEW OF THE LITERATURE

The following literature review examines the nature and extent of current knowledge concerning physical test modifications for normal and mildly handicapped (LD, EMR, EH) populations. It specifically addresses (a) print, (b) line length, (c) the arrangement of similar items in a hierarchy of progressive difficulty, (d) physical layout (workspace, cells per page), (e) administration (directions, increased ratio of example per skill change), and (f) answer format (separate answer sheet, answer bubble placement). A review of current research in the area of minimum competency test modifications and characteristic needs of handicapped individuals is also included.

#### Background

Information in this review was obtained from several sources. These included (a) an ERIC search, (b) examination of the Current Index of Journals in Education (CIJE), and (c) examination of the Educational Index. The descriptor utilized for the ERIC search was "test construction modifications." The descriptors used for the second and third sources were "test construction," "test modifications,"

"testing the handicapped," "learning disabilities (LD)," "emotionally handicapped (EH)," "educable mentally retarded (EMR)," "minimum competency testing," "reading achievement," and "print/type."

Additional sources included Dissertation Abstracts International and the card catalog system in the University of Florida library (for textbooks on print and typography).

The review of the literature revealed that the area of physical test format modifications, specifically designed for elementary mildly handicapped children, has received little attention by researchers. The sample populations of studies varied in age of students (elementary, secondary, college, and adult), handicap (normal individuals, visually impaired, LD, EH, EMR), and degree of handicap (severe, moderate, and mild). Due to this paucity of research material specific to age and type of educational handicap, the selection criterion for inclusion in the literature review was very broad. A decision was made to include all accessible information regarding test construction principles and their application. This information, restricted to neither age nor handicap, was collected from data based research, survey studies, authority based good practices, and expert opinion.

Therefore, the literature for each test modification does not always address the targeted population of the current study. In fact the test modification of increased ratio of examples per skill change was not even addressed in the literature. Consequently, the studies will be reported as either "verified" (substantiated by expert opinion or data based research) or "unverified" (not specifically addressed by research but suggested by professionals). Those modifications that

can be categorized as verified are (a) print (boldface), (b) line length, (c) item grouping, (d) physical layout, (e) administration (directions), and (f) answer format (in booklet response, answer bubble placement). The one modification that must be classified as unverified is the increased ratio of examples per skill change.

### Verified Test Modifications

#### Print

In relationship to the process of reading, print is regarded as a crucial element (Fonda, 1968; Sykes, 1971; Tinker, 1963a). Fonda (1968) stated that such factors as style of print, blackness of the ink, contrast of white non-glossy paper to the ink, and appropriate illumination facilitate reading. Tinker (1963b) used these same features to define visibility. He stated that visibility was affected by the combination of the brightness of the paper, the darkness of the ink, and the thickness of the strokes in the letter. He also noted that an increase in the visibility can make the type appear larger.

According to Shaw (1969) and Sykes (1971) legibility of print is controlled by such characteristics as quality, size, weight, and spacing. Erdmann and Neal (1968) stated that legibility increases with the height and resolution of the character. The presence of serifs (the horizontal and vertical strokes that are attached to the end points of basic letters) and simplicity also contribute to this legibility of print (Tinker, 1963a).

There appears to be a general consensus among experts regarding the use of upper and lower case letters, italics, and boldface type. Tinker (1963a) and Craig (1971) recommended the use of boldface type as an effective means for emphasizing an important concept or word, or for drawing attention to a critical element. The use of lower case letters is preferred to upper case or italics since lower case can be read more quickly (Tinker & Patterson, 1928; Tinker, 1963a) and more easily (Craig, 1971). Craig (1971) contended that lower-case letters facilitate the process of reading due to a presence of greater visual cues. This can be seen by splitting a word horizontally. The reader receives more decoding clues from lowercase ~~chair~~ than uppercase ~~CHAIR~~. Sawyer (1975) suggested that words not be typed in all capital (uppercase) letters and Tinker (1963a) reported that capitals and italics retarded the speed of reading.

### Line Length

According to Tinker (1963b) the normal line width is 39 characters, although this may vary up to 65 depending on different sizes of type (Craig, 1971). Line length has an important effect on reading. Lines that are too short can break up phrases and logical thought units (Craig, 1971). On the other hand, there are also disadvantages to lines that are too long. Excessively long lines make it difficult to find the beginning of the next line (Tinker, 1963a) and long lines can also cause fatigue (Craig, 1971).

Lines of print are usually set by printers to give a "justified" or even appearance. Justified lines have even left and right margins

and are usually found in newspapers, magazines, and books. Paragraphs with justified line lengths approximate a box with parallel sides. The printers are able to create this even appearance by altering the spacing between individual letters and words.

Craig (1971), however, suggested that equal spacing between words creates greater legibility. The equal spacing creates uneven or "unjustified" line lengths and lines take on a jagged effect. The jagged effect has texture, adds visual interest to the page, contributes to the ease of reading, and reduces the difficulty of locating the beginning of the next line (Craig, 1971). Results of a study by Reichard and Reid (1970) indicated that retarded children demonstrated increased reading rates and improved reading comprehension scores on reading passages that were set in unjustified lines with double spaced leading (i.e., space between lines of print).

Leading is the amount of white space between lines of print. It is another factor that can alter the effectiveness of line lengths. Too little or too much spacing can be distracting. Craig (1971) stated that too much leading can cause a drifting effect and the type takes on a grayish cast (as opposed to true black). He recommended that leading between lines be greater than the spacing between the individual words. Appropriate leading is also responsible for increasing visibility on a page when the paper is low in brightness or the reading light is poor (Tinker, 1963b).

Although Craig (1971) stated that proper leading is more a matter of visual judgment than specific mathematical determinations of space,

there are certain characteristics that do regulate the amount of leading necessary. He felt that more leading was needed with (a) letters of large X heights, (b) letters of strong vertical stress, (c) sans serif type as opposed to serif type, (d) longer lines, and (e) very small type.

### Item Grouping

There is some controversy in the literature (involving normal individuals) with regard to the grouping of like items and the presentation of such items in a hierarchy of progressive difficulty. Brenner (1964), Sirotnik and Wellington (1974), and Marso (1970) suggested that scrambling test items had no effect on the test scores for normal individuals (8th grade to college). Holliday and Partridge (1979) and Flaughner, Melton, and Meyers (1968), however, suggested that hierarchies of items progressing from easy to hard (rather than a random or descending order) did improve test scores for normal second graders and high school students. A study of 5,000 normal high school students by Flaughner, Melton, and Meyers (1968) supported the idea that reordering test items does not create a new test.

There appeared to be no empirical data available concerning the effect of item grouping on handicapped students. It seemed, however, that handicapped children would benefit from the grouping of similar items. Grouping similar items would tap all items within one particular skill and create task consistency. This could eliminate the confusion and/or carelessness that often results from requiring a student to cognitively jump from one skill to another and back again.

Ordering the items from easiest to most difficult would also appear to help the handicapped student. When items are scrambled, there is no assurance an EMR or EH child will continue past the difficult item until he reaches another item he knows. Educationally handicapped students may become frustrated with a difficult problem and abandon the rest of the items. By combining these two features, grouping and ordering, a test could be logical and reinforcing to a handicapped child. The discouragement a child may feel as he reaches the limit of his ability on one skill could be counter-balanced by successful accomplishment on the easier tasks of the next skill.

### Physical Layout

Cells per page. Since educationally handicapped children often demonstrate visual perception problems, educational materials should optimally be characterized by limited and well organized stimulus. In order to create a clean and uncluttered page, test problems may be enclosed within a cell or box. Cells can be created by extending horizontal lines across the page and by placing one vertical line down the center of each page. These lines create a well balanced page that resembles Sample 1 (Figure 1). Cells in other tests are inconsistent in size due to randomly placed horizontal lines. For example, some test pages may resemble Sample 2 (Figure 1). Such an imbalanced page may be distracting and promote confusion for a handicapped child. In Greenberg's (1980) study with handicapped students, it was recommended that each page consist of a maximum of six cells; however, the results of her study did not prove that this number was critical. Research in this area is obviously limited.

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Sample 1  
Well Balanced Page

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Sample 2  
Imbalanced Page

Figure 1

Workspace. There is also limited research available on this topic. Provision of workspace (for math and reading word problems) was investigated in a study by Majors and Michael (1975). Their research indicated that children in seventh grade scored higher on tests that provided workspace. Handicapped learners provided with workspace may systematically and logically work math and reading word problems out rather than guessing the answer. The success of the workspace modification would be closely associated with the teacher's effectiveness in encouraging and persuading the students to utilize the workspace.

#### Administration

Directions and procedures. Tests often require the children to read and comprehend written directions independently. This assumes that all children have the ability to do the initial task and can then proceed to the individual test items. Unfortunately, this may be an erroneous assumption for many handicapped individuals. How can poor readers demonstrate their cognitive proficiency on other tasks when they are unable to decode the information provided in the directions? Consequently, test directions and general administration procedures become critical elements of the assessment process. It is essential that tests are an accurate measurement of a child's cognitive ability and not of his ability to respond to the test format.

In New Jersey, Basic Skill Tests administrators are permitted to repeat, reword, and clarify directions and examples for handicapped children (Greenberg, 1980). This assures that the children understand

the task and are not attempting any task that is unclear. In an attempt to measure skills and not the ability to read, procedures in New York (Clift, 1979), Virginia, New Jersey, and North Carolina (Grise, 1981) allow the math and reading sections of the minimum competency test to be read to some handicapped students, while Florida allows only the math and writing portions to be read to the handicapped students (Florida Statutes 232.246, 1979).

In addition to problems of decoding directions, some handicapped students also exhibit problems of attention. In a study by Margolis, Brannigan, and Penner (1978) directions were modified for 16 children who were labeled as impulsive. Test administrators read the examples orally, and presented the logic behind choosing the correct answer. The investigators were successful in teaching the children how to examine tasks deliberately and logically. Instead of reacting to a new and uncertain situation in their traditionally habitual and impulsive manner, the children began to solve tasks systematically and rationally.

#### Answer Format

Within test booklet response. Several studies support the procedure of having students answer directly in their answer booklet as opposed to transferring answers to a separate answer sheet. Muller, Calhoun, and Orling (1972) suggested that the transfer of answers to separate answer sheets required ability in (a) encoding, (b) short term memory, and (c) motor coordination. Their study found that normal third, fourth, and sixth graders answered more items correctly

in their booklets (on a ratio of 3:1) than on a separate answer sheet. Gaffney and Maguire (1971) stated that separate answer sheets were invalid for use with normal children below fifth grade. Other results supporting the use of direct response in the test booklet were stated by Cashen and Ramseyer (1969) for normal children in grades 1-2, Beck (1974) with normal children in grades 3-4, Majors and Michael (1975) for normal seventh and eighth graders, Clark (1968) for slow learners, and Greenberg (1980) for handicapped (EH, LD, EMR) fourth graders.

Placement of answer bubbles. Since the literature appeared to support the procedure of marking answers within individual test booklets, studies that pertained to the most effective placement of the answer bubbles were of interest. Only one report was available on the physical arrangement of answers. Hartley, Davies, and Burnhill (1977) compared four answer forms that varied in the placement of the bubbles to the left or right of the answers. The results indicated that normal 11-12 year old children demonstrated no significant preference for any particular placement. No studies were found that investigated a handicapped population.

Theoretically, when answer bubbles are positioned on the left, the following perceptual errors may occur within an elementary handicapped (EMR, EH, LD) population: (a) reversals; when the child moves (right to left) across the number to fill in the bubble, he may reverse the foil "012" to read "21 answer bubble", or (b) visual mismatching; when a child attempts to shade in one of the four answer

bubbles presented, his fist/fingers may be covering the answers. Moving the bubbles to the right side of the answer may promote a left to right reading sequence and avoid the accidental mistakes that occur while filling in the bubbles.

Unverified Modification;  
Increased Example/Skill Ratio

There appeared to be no studies available that discussed the value of examples or their effect on children's test performance. What is the purpose of examples? Do they facilitate comprehension of directions and completion of a task?

Hypothetically, it would seem that the difficulty of a test would increase as the number of examples decreased. Tests with few examples (2-4 examples for 120 questions or 25 skill changes) may be measuring a handicapped child's ability to read directions and respond to skill changes independently, rather than assessing his true cognitive abilities on those particular skills. It would appear that a modified test which increased the ratio of examples, relative to the introduction of each new skill change, may be a positive change. Implementation of this theory would provide the educationally handicapped child with directions and a sample problem prior to each new series of tasks.

### Characteristic Needs of Handicapped Individuals

The diagnosis of a mildly handicapping condition evolves from the basic premise that the child does not learn as other children do. He frequently demonstrates certain behaviors that prohibit him from acquiring knowledge in a traditional manner. These behaviors or characteristics necessitate modifications in teaching style and/or presentation of materials. Given the opportunity to learn, however, the mildly handicapped child is capable of learning. His "needs" to accomplish this task are simply different than his nonhandicapped peers.

Summarizing the findings of noted authorities, Morsink (1977) listed some characteristics of mildly handicapped children that may impede learning. These include

(a) Attention difficulties. Some children may have problems concentrating on a specific task, may be unable to use attention selectively, or may be overselective in its use. This inability may result in limited task behavior or impulsive guessing.

(b) Perceptual problems (auditory/visual/motor). Children with these problems tend to have difficulty discriminating differences between similar items. They may also focus on the irrelevant details of a task or concept.

(c) Social-emotional problems. Frequently, mildly handicapped children demonstrate poor attitudes towards school and appear to be unmotivated to learn. It becomes increasingly difficult for these children to attempt academic tasks with enthusiasm when they have

continually failed in the past. Poor self-concepts and extremely low frustration levels only complicate an already difficult task.

(d) Memory problems. These children often demonstrate deficiencies in the ability to store and retrieve auditory and/or visual stimulus. Although they may be able to learn the task initially, they become plagued with the inability to recall the information after a period of time.

(e) Language deficits. Mildly handicapped individuals frequently demonstrate weak oral and written language skills. Complex linguistic passages become difficult to understand and the child simply does not know what is being asked of him . . . let alone do it.

(f) Transfer difficulties. These children tend to have problems structuring, generalizing, and seeing relationships. They appear to be unable to integrate smaller parts into a whole.

These deficits make it difficult for the handicapped child to learn or respond by traditional means. Ideally, a learning environment will control for these variables. It is this control that then allows optimum learning and assessment to occur.

#### Current Research in MCT Modifications for Handicapped Individuals

According to the National Association of State Directors of Special Education (1979) only seven states have already made or are in the process of making special accommodations in MCT procedures for handicapped children. This is supported by the finding of Smith and Jenkins (1980) that five of the reporting states (Colorado, Florida,

Georgia, Kansas, and Louisiana) have indicated the formal provision of special testing procedures for categorical groups of handicapped students.

The state surveys also indicate that current modifications tend to concentrate on the severely handicapped populations. For example, the MCT for visually and hearing impaired individuals has been modified by using braille, large size print, audio supplement, or sign language (McClung, 1979; McClung & Pullin, 1978; Smith & Jenkins, 1980). On the other hand, some handicapping conditions (educable mental retardation) have received no testing modifications (McClung & Pullin, 1978), and the mildly handicapped students have received minimal attention.

Education specialists in the state of Florida are apparently well aware of the problems involved with testing handicapped learners. McCarthy (1980) stated that Florida has the most elaborate legislative regulations to date. The statutes provide for

appropriate modification of testing instruments and procedures for students with identified handicaps or disabilities in order to ensure that the results of the testing represent the student's achievement, rather than reflecting the student's impaired sensory, manual, speaking, or psychological process skills, except where such skills are the factors the test purports to measure. (Florida Statutes, Chapter 232, Section 246)

According to the Florida Administrative Code, the following test modifications have been proposed for handicapped students:

1. Flexible scheduling

The student may be administered a test during several brief sessions so long as all testing is completed by the final allowed test date specified by the Commissioner.

## 2. Flexible setting

The student may be administered a test individually or in small group setting by a proctor rather than in a classroom or auditorium setting.

## 3. Recording of answers

The student may mark answers in a test booklet, type the answer by machine, or indicate the selected answers to a test proctor. The proctor may then transcribe the student's responses onto a machine-scoreable answer sheet.

## 4. Mechanical aids

The student may use a magnifying device, a pointer, a non-calibrated rule or template, or other similar devices to assist in maintaining visual attention to the test booklet.

## 5. Revised format

The test may be presented to the student using one or more of the following techniques.

(a) visual reading—regular or enlarged print.

(b) tactile reading—braille code or technology to allow optical/tactile transformation; test items which have no real world applications for the blind person will be deleted from the test form provided by the Department.

(c) the mathematics and writing portions may be presented in sign language; all directions may also be presented in sign language and the reading portion of the test must be read by visual or tactile means.

(d) auditory presentation—an audio-taped version of the mathematics and writing portions of the test, in a form provided by the

Department, may be presented; the test administrator may read a script version of the test to the student; however, the reading portion of the test must be read by visual or tactile means.

(Proposed State Board Rule 6A-1.943, State of Florida, 1980)

As progressive as the Florida modifications may be in comparison with those of other states, they may be somewhat misleading. The current emphasis appears to be on the more general "procedural" modifications (i.e., where and when of testing) than on the actual construction of the test. Although these modifications may be beneficial, it would appear that mildly handicapped populations may require additional test modifications involving test design and physical formatting (i.e., issues dealing with print, color, spacing, consistency, or realism).

There is little research data available in the area of specific test modifications on test performance of handicapped learners. Although many educators espouse the legal and educational need for such modifications (Denninger, 1979; Kaluzny, 1979; McCarthy, 1980; McClung & Pullin, 1978; Smith & Jenkins, 1980) there have been only three known studies using modified formats for state assessment tests.

#### State Research Studies

New Jersey. A project in New Jersey under the direction of Lydia Greenberg, Coordinator of State Testing Program, New Jersey State Department of Education (1980), compared group performances of special children on modified state assessment tests. The New Jersey Minimum Basic Skills Test was field tested with fourth, seventh, tenth, and

twelfth grade handicapped students, assessing reading and math skills. The areas of handicapping conditions included communication impaired, mentally retarded, emotionally disturbed, orthopedically handicapped, chronically ill, perceptually impaired, neurologically impaired, multiply handicapped, and socially maladjusted. In contrast with their performance on the standard test, the students in grades 7, 10, and 12 had higher scores on the revised reading test. There was no significant difference between student performance on the revised and standard math subtests at any grade level. Even with the noted reading score improvement, however, the handicapped population still scored below the normal group of students.

Based on the analysis of the field test, the following modifications appeared to have the greatest impact in the study according to Greenberg (1980):

1. The print was enlarged.
2. Time limits were extended (approximately twice the normal amount of time allotted). The teacher was asked not to mention any time limit.
3. Practice tests were developed for the handicapped students at the four grade levels. The purpose of this was to acquaint the students with test taking techniques. It was administered one to two weeks before the actual testing.
4. Students could be tested alone or in small groups.

At the conclusion of the field testing, administrators made the following recommendations:

a. Transferring answers from the test booklet to the answer sheet caused confusion and anxiety, and the students lost their places. Suggestions were made to have the students mark the answers in the test booklets or respond orally.

b. The wording of directions should be simplified. Administrators should be able to paraphrase instructions. Directions should be repeated or examples re-explained if the student does not understand.

c. Directions should be read aloud to ensure each student understands the task.

d. Markers would help alleviate the problem of students losing their places.

It was also recommended that several variables be considered when determining a student's eligibility for inclusion in the minimum competency testing program. Handicapped students who had previous experience in taking standardized tests appeared to perform better than those who had not. Elementary and secondary special education students who had been staffed into resource rooms performed better than those special education students who had been staffed into self-contained classrooms. It was also recommended that any student functioning at a level two or more years below the content level of the test should be excluded from the test.

Florida. Another study was conducted in the state of Florida by JoEllen Perez (1980). Based on the New Jersey study, a review of the literature, and opinions of teachers and consultants throughout the state of Florida, Perez concluded there were five major areas that

required modification. They consisted of (a) clear presentation of directions and addition of supplemental directions and sample items, (b) various alternatives for indicating responses (i.e., marking answers in the test booklet or giving answers orally); (c) access to an audio presentation of some items; (d) clear print format and print size; and (e) adequate spacing that would facilitate processing of the task.

On the basis of this information, Perez (1980) placed the major emphasis of Florida's modified test on the stimulus/response mode. Using 48 learning disabled (LD) eleventh graders from the Dade County area, Perez administered a modified assessment test with the following changes:

1. One group of students took the test augmented with audio support.
2. Another group of students took a large print (18 pt.) version of the test.
3. A third group took the standard sized print test.
4. All students had unlimited time for responding to test items.
5. Templates or markers (5" x 8" white) were available for all students to use.
6. All students had the option of responding to a test item by circling or underlining (a) the entire item or (b) the corresponding letter in the test booklet.

Results of the study indicated that the large print presentation was superior to the regular print format in five of eight skills

tested. Large print also showed improved scores when compared to audio support in four of eight skills. There was no skill where regular print or audio support was preferred to large print. To accommodate the large print, however, the size of the booklets was also enlarged. Grise' (1980) noted that the older students expressed their dislike, as the booklet size was awkward to handle and it tended to draw attention to the disability.

Some students reported confusion with the audio support presentation of the test. They found it difficult to cope with the combined auditory and visual stimuli. The markers provided in the study were not used by any of the secondary students, although some were seen using their pencils to mark their place. Finally, it did not appear to be possible to use the psychological and IEP data of individual LD students to predict maximum performance on tests with specific modifications.

#### University of Florida Research

The most current study was conducted by Beattie and Algozzine (1981) at the University of Florida. An analysis of the State Student Assessment Test-Part I (SSAT-I) (grade 3 and 5) and a review of the literature indicated that several general physical format modifications could be implemented as potential aids to mildly handicapped students. Specifically, the following changes were made in the standard format to create a modified test.

1. The order of selected items was changed to reflect a hierarchical progression of skills whenever possible.

2. All multiple choice answer options were placed in a vertical format with scoring "bubbles" placed to the right of each choice.

The shape of individual answer bubbles was a horizontal oval.

3. Third grade tests were available in either standard print (12 pt = 2.0 mm) or enlarged print (18 pt = 3.3 mm). Fifth grade tests were printed in enlarged 16 pt (2.9 mm) type and standard size print.

4. Sentences for reading comprehension items were arranged in an unjustified format when possible; that is, complete sentences were left intact creating uneven right hand margins. In contrast, the traditional tests maintained the justified formatting which is characterized by equal left and right hand margins.

5. Reading comprehension passages were placed in shaded boxes immediately above the test items related to them.

6. Examples were provided for each skill grouping within the individual test sections. All examples were set apart from the test items by boxes.

7. Specific words that required additional emphasis were printed in boldface type as opposed to uppercase (capital letters), italics, or underlining.

8. Pictorial representations of coins were displayed with the head or face side up. This was in contrast to the traditional tail side up format.

9. Test items that required a logical sequencing of events were placed in a horizontal row of boxes as opposed to positions within the four quadrants of a square.

10. Arrows were placed in the lower right-hand corner of pages to indicate continuing sections of the test. Stop signs were positioned similarly, denoting an end to each skill section.

A total of 679 third and fifth grade learning disabled (LD) students from seven counties in Florida participated in the study. Results indicated that the third and fifth grade LD students' performance on the modified SSAT-I was comparable to or better than that on the regular SSAT-I for approximately 75 percent of the test items evaluated. Detailed analysis of specific modifications revealed that (a) both third and fifth grade LD students performed consistently higher on modified test items presenting coins face up; (b) third grade LD students performed better on the modified sequencing section (the skill was not presented in the fifth grade test); and (c) there was no significant difference between the LD students' performance on tests printed in standard type and their performance on tests printed in enlarged print.

### Summary

The review of the literature revealed very few studies that applied to physical test modifications designed for mildly handicapped elementary aged children. Due to current legal and educational issues involved in non-discriminatory testing, there is a definite need for additional research.

Print authorities appear to support the use of boldface lowercase print as an effective means for emphasizing important words or concepts.

They also agree that words written in capital letters or italics slow down the rate of reading. In spite of this agreement, however, there were no studies available that establish the effectiveness of these printing procedures with various handicapped populations.

There appear to be conflicting data regarding the effectiveness of enlarged print with handicapped populations. Additional research with various handicapped individuals may be warranted in order to measure the effect of enlarged print on the type of handicap and the different ages of the subjects.

Typographers recommend the use of unjustified lines for greater legibility and ease of reading. The presence of only one empirical study to date with ahndicapped children also suggests the need for continued research in the area.

There appears to be much controversy in the literature regarding the benefits of grouping similar items in a hierarchy from easy to hard for normal children. There are no known studies measuring the abilities of handicapped children with scattered items or groups of items in no order of difficulty.

The literature contains sufficient evidence to warrant the conclusion that elementary handicapped children do perform better when required to respond directly in their answer booklets as opposed to transferring answers to a separate answer sheet. On the other hand, research appears limited in regard to the effects of physical formatting of answer bubbles. The literature does not address the issue of increased accuracy of handicapped children's response when answer bubbles are placed before, after, above, or below the answer foil.

Research is also limited in regard to physical formatting of individual test items. Although one study recommended the maximum of six cells per page be used, the results of the study did not prove that this number was critical. There appear to be no data that measure the confusion handicapped children may experience from random placement of test items.

Finally, no relevant data could be found on the recommended number of examples per skill change for either normal or handicapped populations. For the purpose of this study, the inclusion of this modification was based on logic and the current knowledge available regarding the learning characteristics of handicapped and normal children.

Based on this review, the following physical test format modifications appear to be warranted for continued research. They include the effectiveness of boldface type for emphasis, unjustified formatting of sentences, grouping of similar tasks in a progressive hierarchy, inclusion of examples to facilitate task transition, and the placement of answer bubbles in relation to foil.

The effect of these modifications on the performance of students with such mildly handicapping conditions as LD, EMR, and EH is of primary interest. The inclusion of a normal group of individuals may reveal that specific modifications are simply "good" test construction formatting principles, applicable and beneficial to the majority of average individuals.

### CHAPTER III

#### METHODS AND PROCEDURES

Chapter III includes a description of the methods and procedures used in this study. There are two major sections in this chapter; the first is a description of subjects, and the second is a description of the experimental procedures including materials, setting, variables, hypotheses, and data analysis.

#### Method

The research was conducted in Alachua County and in the city of Orlando, which is comprised of three counties (Orange, Seminole, and Osceola). Alachua County is located in north central Florida, encompasses an area of approximately 965 square miles, and has a population of 133,817. Metropolitan Orlando is located in central Florida, is approximately 2600 square miles, and has a population of 723,903.

Four categories of students from the third grade participated in the study. These included normal students and those students with such mildly handicapping conditions as learning disabilities (LD), emotional handicaps (EH), and educable mental retardation (EMR). Criteria used in the determination of these mildly handicapping

conditions are listed in Appendix A.

Each group of subjects (LD, EH, EMR, normal) contained 20 students, for a total population of 80 subjects. Permission to participate in the study was obtained from each student's parent/guardian. Parent permission slips are in Appendix B.

Selection of students was done randomly. In Alachua County, there was a limited number (9) of diagnosed third grade EMR students. As a result, principals of those schools were contacted for permission to test. In addition to selecting those particular EMR students, the third grade LD and EH children and a proportionate number of normal third grade children in those schools were also selected for participation in the study. Orange County Special Education Coordinators randomly selected 10 schools and obtained principal permission for the LD, EH, EMR children in those schools to participate in the study.

In each county the children were randomly matched within each category according to reading levels obtained from a Ginn reading series test or Woodcock Reading Mastery Test. Students reading on the same level were then randomly assigned to take either a modified or standard version of a test. The mean reading level for the entire population was 2.4 (fourth month of second grade). The average reading levels by category were (a) normal subjects—grade 3.2, (b) learning disabled — grade 2.1, (c) emotionally handicapped — grade 2.5, and (d) educable mentally retarded — grade 1.8. Analysis of these differences indicated that LD and EMR students performed similarly, as did EH and LD students. Normal students consistently performed higher than all other groups.

The subjects were evenly distributed ( $\chi^2 = 0.21$ ,  $0.005$ ,  $p > .05$ ) across test types with regard to sex and race; 49 males (23 standard, 26 modified), 31 females (17 standard, 14 modified), 40 black (19 standard, 21 modified), and 40 white (21 standard, 19 modified). Consistent with past findings in special education literature, however, sex and race were not evenly distributed across categories. Specific examples of relationships between race/sex and special education placement are three times as many white children in LD as black and almost six times as many boys in EH as girls. A breakdown of the four categories by race and sex is presented in Table 1.

Table 1  
Category Membership by Race and Sex

| Category | Race            |           | Sex             |           |
|----------|-----------------|-----------|-----------------|-----------|
|          | Black           | White     | Male            | Female    |
| Normal   | 14(17.5%)       | 6( 7.5%)  | 8(10.0%)        | 12(15.0%) |
| LD       | 5( 6.3%)        | 15(18.8%) | 12(15.0%)       | 8(10.0%)  |
| EH       | 11(13.8%)       | 9(11.3%)  | 17(21.3%)       | 3( 3.7%)  |
| EMR      | 10(12.5%)       | 10(12.5%) | 12(15.0%)       | 8(10.0%)  |
|          | $\chi^2 = 8.40$ |           | $\chi^2 = 8.58$ |           |
|          | $p < .05$       |           | $p < .05$       |           |

### Experimental Procedures

Each of the 80 randomly selected subjects was asked to complete a 100 item test. All testing occurred in a designated classroom in the school; students took the test in small groups of 2-7. The effects of various test modifications on the performance of four groups of students were evaluated using appropriate inferential statistics.

### Materials

The students were randomly assigned to take one of two tests, either a standard or modified version. Each test contained 100 items with multiple choice answers; answers were marked within the test booklet. The test items were identical in content, differing only in physical format. Internal consistency estimates for standard and modified total tests ranged from .85 to .96. Reliability measures for the five modification subtests generally ranged from .61 to .94, with three subtests scores falling below .60. Refer to Table 2 for the reliability of the total test and each subtest by category.

The standard test consisted of five groups of 20 items. These items were characterized by exclusion of examples in transition from skill to skill (#1-20), an inconsistent method of denoting emphasis (#21-40), placement of answer bubbles to the left of the foils (#41-60), a presentation of skills in a mixed hierarchy of difficulty (#61-80), and justified line lengths (#81-100). A sample test in standard format is included in Appendix C.

Table 2  
Internal Consistency Estimates for  
Standard and Modified Tests

| Test<br>Version | Category | Total | Subtests |          |                   |           |                |
|-----------------|----------|-------|----------|----------|-------------------|-----------|----------------|
|                 |          |       | Example  | Boldface | Answer<br>Bubbles | Hierarchy | Line<br>Length |
| Standard        | Normal   | .92   | .74      | .62      | .62               | .75       | .93            |
|                 | LD       | .94   | .65      | .87      | .91               | .71       | .79            |
|                 | EH       | .96   | .78      | .91      | .82               | .94       | .83            |
|                 | EMR      | .88   | .63      | .71      | .64               | .72       | .84            |
| Modified        | Normal   | .85   | .55      | .69      | .19               | .66       | .80            |
|                 | LD       | .90   | .61      | .83      | .85               | .76       | .30            |
|                 | EH       | .93   | .68      | .90      | .58               | .67       | .86            |
|                 | EMR      | .91   | .79      | .62      | .78               | .90       | .61            |

The modified test also consisted of five groups of 20 items. These items, however, were characterized by the inclusion of examples and teacher explanation at the beginning of each new skill section (#1-20), the use of boldface type to denote emphasis (#21-40), placement of answer bubbles to the right of the answer foils (#41-60), grouping of similar items in a hierarchy of progressive difficulty (#61-80), and unjustified line length (#81-100). A sample modified test is included in Appendix D

### Setting

The subjects were removed from their regular classrooms and taken to one room where the standard and modified tests were administered to a group of approximately 2-7 students. Before beginning the test the following statement was read to the subjects.

Today you are going to take a special test. You probably have seen questions like these in your classroom work. I want you to take your time and answer as many questions as you can. Raise your hand if you have any questions. Are there any questions now? Good luck!

The tests were administered on two consecutive days. The students were given items #1-60 of their respective test during the first session which lasted approximately 60-75 minutes. Items #61-100 were administered on the next day with that session lasting approximately 45-60 minutes. Upon completion of the test, the subjects returned to their regular classroom setting.

### Variables

The effects of the experimental procedure on students' test performance scores was measured. Four groups of students were evaluated using two different test formats; performance scores on the total test and comparable subtests were analyzed.

The independent variables in this study were type of student and test type. Students were characterized as normal, learning disabled, emotionally handicapped, or educable mentally retarded. Tests

comprised of standard and modified formats were used; the modifications included (a) the grouping of similar items in a hierarchy of progressive difficulty, (b) the arrangement of line lengths in an unjustified manner, (c) the introduction of examples and directions for each new skill change, (d) the placement of answer bubbles to the right of each foil, and (e) the use of boldface type for emphasis.

The dependent variable in this study was the raw score indicating the student's performance on the total test or group of selected test items. Equal numbers of test items were included for each test modification.

### Hypotheses

A series of related hypotheses were addressed. These included:

1. There is no difference in total test performance of various groups of students as a function of the nature of the test (i.e., modified vs. standard form).
2. There is no difference in the performance of various groups of students on selected items as a function of an increased ratio of examples to skill changes.
3. There is no difference in the performance of various groups of students on selected test items as a function of boldface type.
4. There is no difference in the performance of various groups of students on selected test items as a function of answer bubble placement.
5. There is no difference in the performance of various groups of students on selected test items as a function of item grouping.

6. There is no difference in the performance of various groups of students on selected test items as a function of unjustified line lengths.

### Data Analysis

The data analysis was conducted in the following manner. There was a comparison of test scores on the standard and modified test form for each of the handicapped (LD, EH, EMR) and normal groups. Two factor analyses of variance (ANOVA) were completed for the total test performance score and performance on each set of similar items. Main effects and interactions were analyzed and subsequent follow-up analyses were completed as necessary; the 5 percent level of confidence was used for all tests. Tables were prepared for the total test scores and each set of test modification items. Additionally, a post hoc comparison of student performance on certain skill cluster of items was completed; differences between modified and standard test performance were evaluated using criteria developed by the Florida State Department of Education.

### Summary

The purpose of this study was to compare total test performance scores of two tests between four groups of students. Performances of each group of students on selected test item modifications were also investigated as were differences in skill mastery levels.

Eighty third grade students from Alachua County and metropolitan Orlando, Florida, participated in the study. Twenty students were

randomly selected for each of the four categories; half taking the modified test items and half taking the standard version of the test. The 100 item tests were administered to small groups of students, two to seven students per group. The test was given on two consecutive days; approximately 60 minutes and 45 minutes sessions respectively each day. A standard statement was read to all students prior to beginning the test.

Two factor analyses of variance were completed for the total test performance score and performance on each set of similar items. Main effects and interactions were analyzed and subsequent follow-up analyses were completed as necessary using a 5 percent level of confidence.

## CHAPTER IV

### RESULTS

This study was conducted to investigate the possible effects of five physical test format modifications on the performance of mildly handicapped and normal third grade students. The modifications included an increased ratio of examples per skill change, the use of boldface type for emphasis, the placement of answer bubbles, the grouping of similar items in a hierarchy of progressive difficulty, and unjustified line lengths.

Eighty students from Alachua County and metropolitan Orlando schools participated in the study. There were 20 students in each of four categories (LD, EH, EMR, normal). The students within each category were randomly matched according to reading ability and randomly assigned to either standard or modified test forms.

Data were analyzed using two factor analyses of variance (ANOVA) for the total test performance score and the performance on each set of similar items (subtests 1-5). Significant main effects for category were further evaluated using follow-up analyses according to Tukey's Honestly Significant Differences (cited in Ferguson, 1971) procedure; main effects for differences in test forms were interpreted as F ratios due to the presence of only two levels of that independent variable. Level of significance of all tests was set at  $\alpha = .05$ .

Means, standard deviations, and analysis of variance summary table for total test performance are presented in Table 3. Significant main effects are indicated for both category and test form. Similar information relative to student performance on the five modification subtests (i.e., examples, boldface type, answer bubble placement, progressive hierarchy, and unjustified line length), is presented in Tables 4 to 8.

Total performance on the modified test ( $\bar{x} = 75.20$ ) was approximately six points higher than on the standard test form ( $\bar{x} = 68.95$ ). As revealed in the follow-up analyses, performance of EH and LD students was similar as were normal and EH students. The scores of the mentally retarded students and LD students, however, were significantly lower than normal students.

With regards to subtest scores, there were no differences in test form for four out of five modification subtests; the one exception was the example subtest. On the example subtest, students achieved higher scores on the modified version ( $\bar{x} = 15.67$ ) than on the standard version ( $\bar{x} = 14.02$ ). As indicated in follow-up analyses, performance of EH and LD students was consistently similar on all subtests; this was also true of normal and EH students. Learning disabled and normal students performed similarly on only 33 percent of the tests; EMR children always performed lower than other categories of students. Results of all follow-up analyses are presented in Table 9; similar means are denoted by an underline.

Table 3  
Means and Standard Deviations for Students' Performance  
on Standard/Modified Test

| Category | <u>Total Score</u> |      | Standard Deviation |
|----------|--------------------|------|--------------------|
|          | Test Form          | Mean |                    |
| Normal   | Standard           | 89.3 | 10.6               |
|          | Modified           | 92.9 | 6.2                |
| LD       | Standard           | 71.5 | 16.8               |
|          | Modified           | 78.3 | 12.4               |
| EH       | Standard           | 76.3 | 20.1               |
|          | Modified           | 83.3 | 12.9               |
| EMR      | Standard           | 38.7 | 13.0               |
|          | Modified           | 46.3 | 15.5               |

| <u>Analysis of Variance Summary</u> |                     |                 |                        |        |
|-------------------------------------|---------------------|-----------------|------------------------|--------|
| Source                              | Sums of Squares(SS) | Mean Square(MS) | Degrees of Freedom(df) | F      |
| Category                            | 26085.75            | 8695.25         | 3                      | 44.32* |
| Test Form                           | 781.25              | 781.25          | 1                      | 3.98*  |
| Category X Test Form                | 48.55               | 16.18           | 3                      | .08    |
| Error                               | 14125.89            | 196.19          | 72                     |        |

\*  $p < .05$

Table 4  
Means and Standard Deviations for Students' Performance  
on Subtest for Example Modification

| Category | <u>Examples</u> |      | Standard Deviation |
|----------|-----------------|------|--------------------|
|          | Test Form       | Mean |                    |
| Normal   | Standard        | 18.1 | 2.4                |
|          | Modified        | 18.8 | 1.5                |
| LD       | Standard        | 15.5 | 2.9                |
|          | Modified        | 16.0 | 2.7                |
| EH       | Standard        | 15.4 | 3.7                |
|          | Modified        | 16.9 | 2.6                |
| EMR      | Standard        | 7.1  | 3.2                |
|          | Modified        | 11.0 | 4.4                |

| <u>Analysis of Variance Summary</u> |                     |                 |                        |        |
|-------------------------------------|---------------------|-----------------|------------------------|--------|
| Source                              | Sums of Squares(SS) | Mean Square(MS) | Degrees of Freedom(df) | F      |
| Category                            | 982.00              | 327.33          | 3                      | 35.22* |
| Test Form                           | 54.45               | 54.45           | 1                      | 5.86*  |
| Category X Test Form                | 36.55               | 12.18           | 3                      | 1.31   |
| Error                               | 669.19              | 9.29            | 72                     |        |

\*  $p < .05$

Table 5  
Means and Standard Deviations for Students' Performance  
on Subtest for Boldface Type Modification

| Category | Test Form | <u>Boldface</u> |                    |
|----------|-----------|-----------------|--------------------|
|          |           | Mean            | Standard Deviation |
| Normal   | Standard  | 17.7            | 2.2                |
|          | Modified  | 18.5            | 2.0                |
| LD       | Standard  | 13.6            | 5.0                |
|          | Modified  | 15.3            | 4.1                |
| EH       | Standard  | 14.9            | 5.4                |
|          | Modified  | 16.5            | 4.7                |
| EMR      | Standard  | 7.1             | 3.8                |
|          | Modified  | 8.3             | 3.5                |

| <u>Analysis of Variance Summary</u> |                     |                 |                        |        |
|-------------------------------------|---------------------|-----------------|------------------------|--------|
| Source                              | Sums of Squares(SS) | Mean Square(MS) | Degrees of Freedom(df) | F      |
| Category                            | 1191.84             | 397.28          | 3                      | 24.79* |
| Test Form                           | 35.11               | 35.11           | 1                      | 2.19   |
| Category X Test Form                | 2.54                | .85             | 3                      | .053   |
| Error                               | 1153.49             | 16.02           | 72                     |        |

\*  $p < .05$

Table 6

Means and Standard Deviations for Students' Performance  
on Subtest for Answer Bubble Modification

| Category | <u>Answer Bubbles</u> |      | Standard Deviation |
|----------|-----------------------|------|--------------------|
|          | Test Form             | Mean |                    |
| Normal   | Standard              | 18.5 | 1.8                |
|          | Modified              | 18.8 | 1.1                |
| LD       | Standard              | 13.7 | 5.5                |
|          | Modified              | 14.8 | 4.4                |
| EH       | Standard              | 15.5 | 4.0                |
|          | Modified              | 17.4 | 2.1                |
| EMR      | Standard              | 8.3  | 3.4                |
|          | Modified              | 8.3  | 4.1                |

| <u>Analysis of Variance Summary</u> |                    |                 |                        |        |
|-------------------------------------|--------------------|-----------------|------------------------|--------|
| Source                              | Sums of Square(SS) | Mean Square(MS) | Degrees of Freedom(df) | F      |
| Category                            | 1189.94            | 396.64          | 3                      | 30.68* |
| Test Form                           | 13.61              | 13.61           | 1                      | 1.05   |
| Category X<br>Test Form             | 10.94              | 3.65            | 3                      | .28    |
| Error                               | 930.89             | 12.93           | 72                     |        |

\*  $p < .05$

Table 7  
Means and Standard Deviations for Students' Performance  
on Subtest for Hierarchial Modification

| Category | <u>Hierarchy</u> |      |                    |
|----------|------------------|------|--------------------|
|          | Test Form        | Mean | Standard Deviation |
| Normal   | Standard         | 18.5 | 2.2                |
|          | Modified         | 19.2 | 1.3                |
| LD       | Standard         | 16.3 | 2.8                |
|          | Modified         | 17.0 | 2.5                |
| EH       | Standard         | 16.9 | 4.7                |
|          | Modified         | 17.6 | 2.1                |
| EMR      | Standard         | 9.6  | 3.8                |
|          | Modified         | 11.1 | 6.0                |

| <u>Analysis of Variance Summary</u> |                    |                 |                        |        |
|-------------------------------------|--------------------|-----------------|------------------------|--------|
| Source                              | Sums of Square(SS) | Mean Square(MS) | Degrees of Freedom(df) | F      |
| Category                            | 836.55             | 278.85          | 3                      | 22.74* |
| Test Form                           | 16.20              | 16.20           | 1                      | 1.32   |
| Category X Test Form                | 2.40               | .80             | 3                      | .06    |
| Error                               | 882.79             | 12.26           | 72                     |        |

\*  $p < .05$

Table 8

Means and Standard Deviations for Students' Performance  
on Subtest for Line Length Modification

| Category | <u>Line Length</u> |      | Standard Deviation |
|----------|--------------------|------|--------------------|
|          | Test Form          | Mean |                    |
| Normal   | Standard           | 16.5 | 4.9                |
|          | Modified           | 17.6 | 2.9                |
| LD       | Standard           | 12.4 | 4.1                |
|          | Modified           | 15.0 | 2.2                |
| EH       | Standard           | 13.7 | 4.5                |
|          | Modified           | 14.9 | 4.6                |
| EMR      | Standard           | 7.8  | 5.0                |
|          | Modified           | 7.6  | 3.2                |

| <u>Analysis of Variance Summary</u> |                     |                 |                        |        |
|-------------------------------------|---------------------|-----------------|------------------------|--------|
| Source                              | Sums of Squares(SS) | Mean Square(MS) | Degrees of Freedom(df) | F      |
| Category                            | 930.64              | 310.21          | 3                      | 18.89* |
| Test Form                           | 27.61               | 27.61           | 1                      | 1.68   |
| Category X Test Form                | 19.64               | 6.55            | 3                      | .39    |
| Error                               | 1182.29             | 16.42           | 72                     |        |

\*  $p < .05$

Table 9  
Results of Follow-Up Analyses Using Tukey's  
Honestly Significant Differences

|                 | <u>Category</u>           |                       |                       |                        |
|-----------------|---------------------------|-----------------------|-----------------------|------------------------|
|                 | Normal<br>$\bar{x}$ score | EH<br>$\bar{x}$ score | LD<br>$\bar{x}$ score | EMR<br>$\bar{x}$ score |
| Total Test      | 91.10                     | <u>79.80</u>          | <u>74.90</u>          | 42.50                  |
| <u>Subtests</u> |                           |                       |                       |                        |
| Example         | 18.45                     | <u>16.15</u>          | <u>15.75</u>          | 9.05                   |
| Boldface        | 18.10                     | <u>15.70</u>          | <u>14.45</u>          | 7.70                   |
| Answer Bubble   | 18.65                     | <u>16.45</u>          | <u>14.25</u>          | 8.30                   |
| Hierarchy       | 18.85                     | <u>17.25</u>          | <u>16.65</u>          | 10.35                  |
| Line Length     | 17.05                     | <u>14.30</u>          | <u>13.70</u>          | 7.70                   |

Current practice in reporting the results of minimum competency testing in Florida is to present scores that are indicative of mastery of basic skills. The state has established minimum performance standards for each subskill; the number of items correct relative to the total number of subskill items attempted is the basis for decision making relative to "mastery." The mastery criteria currently being used in Florida are presented in Table 10. Within the five different subtests presented in this study, different subskills were included. A post hoc analysis of the student's test performance on specific subskills was completed. Individual scores were calculated for percentage of subskill items correct; these were compared to current state mastery criteria. Results of this analysis are presented in Table 11. On 32 percent of the subskill sections, the difference between performance on the standard and modified tests was the difference between achieving mastery criteria and failing. Overall, the performance scores on the modified test were one to 16 percentage points higher than on the standard test for 80 percent of the individual subskill sections.

Further analysis of the data was completed regarding the number of students achieving mastery by subtest by category. It appeared there were no substantial differences in mastery level for normal students on either standard or modified test versions. Certain test modifications did appear, however, to facilitate mastery levels for various mildly handicapping conditions. For example, numbers of LD, EH, and EMR students achieving mastery

Table 10  
Criteria Used to Determine and Report Mastery of Skills

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| When the number of questions to<br>measure a skill is as follows: | The minimum number of questions<br>required to be answered correctly<br>shall be as follows: |
|-------------------------------------------------------------------|----------------------------------------------------------------------------------------------|
| 2                                                                 | 1 of 2                                                                                       |
| 3                                                                 | 2 of 3                                                                                       |
| 4                                                                 | 3 of 4                                                                                       |
| 5                                                                 | 4 of 5                                                                                       |
| 6                                                                 | 5 of 6                                                                                       |
| 7                                                                 | 5 of 7                                                                                       |
| 8                                                                 | 6 of 8                                                                                       |
| 9                                                                 | 7 of 9                                                                                       |
| 10                                                                | 7 of 10                                                                                      |
| 11                                                                | 8 of 11                                                                                      |
| 12                                                                | 9 of 12                                                                                      |
| 13                                                                | 10 of 13                                                                                     |
| 14                                                                | 10 of 14                                                                                     |
| 15                                                                | 11 of 15                                                                                     |
| 16                                                                | 12 of 16                                                                                     |

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Source: Florida Department of Education. Statistical Report: 1980-81. State and district report of results. Tallahassee, FL: Division of Public Schools, Series 81-05, February 1981.

Table 11  
Comparison of Mean Test Scores for Standard and  
Modified Subtests with Mastery Criteria

|                       | Mastery <sup>1</sup><br>Criteria | Standard Test<br>x percentage<br>score | Modified Test<br>x percentage<br>score |
|-----------------------|----------------------------------|----------------------------------------|----------------------------------------|
| <u>Example</u>        |                                  |                                        |                                        |
| Dollar                | 66%                              | 62.5                                   | * 78.3                                 |
| Fractions             | 66%                              | 75.8                                   | 74.2                                   |
| Measurement           | 66%                              | 85.0                                   | 86.7                                   |
| Sequencing (1st-last) | 75%                              | 76.2                                   | 83.7                                   |
| ABC order             | 75%                              | 55.6                                   | 67.5                                   |
| Math Word Problems    | 66%                              | 63.3                                   | * 81.7                                 |
| <u>Boldface</u>       |                                  |                                        |                                        |
| Not                   | 75%                              | 72.5                                   | * 75.0                                 |
| End                   | 75%                              | 68.7                                   | 69.4                                   |
| Pronoun               | 75%                              | 60.6                                   | * 75.6                                 |
| Opposites             | 75%                              | 65.6                                   | * 75.0                                 |
| Following directions  | 75%                              | 65.6                                   | 71.2                                   |
| <u>Answer Bubble</u>  |                                  |                                        |                                        |
| 2-digit addition      | 75%                              | 85.0                                   | 90.0                                   |
| Math Word Problems    | 75%                              | 71.2                                   | * 85.0                                 |
| Reading Comprehension | 75%                              | 56.9                                   | 61.2                                   |
| Reading Comprehension | 75%                              | 70.0                                   | 68.7                                   |
| Spelling              | 75%                              | 66.9                                   | 65.6                                   |

<sup>1</sup>Based on data in Florida Department of Education. Statistical report: 1980-81. State and district report results. Tallahassee, FL: Division of Public Schools, Series 81-05, February 1981.

Table 11-Continued

|                    | Mastery<br>Criteria | Standard Test<br>x percentage<br>score | Modified Test<br>x percentage<br>score |
|--------------------|---------------------|----------------------------------------|----------------------------------------|
| <u>Line Length</u> |                     |                                        |                                        |
| Reading Comp.-end  | 75%                 | 68.1                                   | 66.2                                   |
| Reading Comp.      | 75%                 | 67.5                                   | 74.4                                   |
| \$ Word Problems   | 75%                 | 51.9                                   | 58.7                                   |
| # Word Problems    | 75%                 | 74.4                                   | * 81.2                                 |
| Reading Comp.-not  | 75%                 | 53.1                                   | 63.7                                   |
| <u>Hierarchy</u>   |                     |                                        |                                        |
| + vertical         | 80%                 | 87.5                                   | 92.0                                   |
| + horizontal       | 80%                 | 77.0                                   | * 86.0                                 |
| - vertical         | 80%                 | 70.5                                   | 70.5                                   |
| - horizontal       | 80%                 | 71.5                                   | 76.0                                   |

\* Indicates those subtests in which mastery criteria was achieved on the modified version but not on the standard version.

criteria were substantially higher when using the modification of unjustified line lengths. Likewise, differences in favor of the boldface type and example modifications were noted for LD, EH students and EMR students respectively. Data supporting these conclusions are contained in Table 12.

In summary, total test performance differences were indicated for both category and test form. As a result of follow-up analyses, no significant differences between EH and LD students' scores nor between those of normal and EH students were indicated. Learning disabled and normal students' performance was significantly different and EMR students' scores were consistently lower than those for any other category of students. A comparison of test forms indicated total performance on the modified test was approximately an average of six points higher than on the standard test form.

Analysis of subtest scores revealed consistent main effects for all categories. The performance of EH and LD students was similar on all subtests; as was that of normal and EH students. Learning disabled and normal students performed similarly on 33 percent of the subtests and EMR children consistently performed lower than other categories of students. The only significant difference in test form was on the example subtest, with higher scores being achieved on the modified form than on the standard version of the test.

Percentage of subskill items within each subtest was compared to Florida's current mastery criteria. Mean performance scores on the modified test were 1-16 percentage points higher than those on

Table 12  
Frequency Count of Students Achieving Mastery  
by Subtest by Category

| Subtest          | Subskill              | N  |    | LD |    | EH |    | EMR |    |
|------------------|-----------------------|----|----|----|----|----|----|-----|----|
|                  |                       | S  | M  | S  | M  | S  | M  | S   | M  |
| Examples         | Dollar                | 8  | 10 | 8  | 9  | 9  | 8  | 1   | 5  |
|                  | Fractions             | 10 | 10 | 9  | 7  | 9  | 7  | 3   | 6  |
|                  | Measurement           | 10 | 10 | 10 | 9  | 10 | 10 | 8   | 5  |
|                  | Sequencing            | 8  | 10 | 8  | 10 | 7  | 9  | 1   | 5  |
|                  | ABC Order             | 10 | 9  | 5  | 7  | 6  | 8  | 1   | 2  |
|                  | Math Word Problems    | 10 | 9  | 7  | 9  | 8  | 10 | 1   | 5  |
|                  | Total                 | 56 | 58 | 47 | 51 | 49 | 52 | 15  | 28 |
| Boldface         | Not                   | 9  | 9  | 7  | 8  | 8  | 7  | 1   | 3  |
|                  | End                   | 10 | 8  | 7  | 8  | 7  | 9  | 3   | 2  |
|                  | Pronouns              | 9  | 10 | 5  | 6  | 6  | 7  | 2   | 3  |
|                  | Opposites             | 9  | 10 | 5  | 9  | 7  | 8  | 3   | 2  |
|                  | Following Directions  | 8  | 9  | 8  | 7  | 7  | 9  | 1   | 0  |
|                  | Total                 | 45 | 46 | 32 | 38 | 35 | 40 | 10  | 10 |
| Answer<br>Bubble | 2-digit Addition      | 10 | 10 | 9  | 10 | 8  | 10 | 6   | 7  |
|                  | Math Word Problems    | 10 | 10 | 7  | 7  | 9  | 10 | 2   | 4  |
|                  | Reading Comprehension | 9  | 7  | 2  | 5  | 6  | 6  | 2   | 0  |
|                  | Reading Comprehension | 9  | 10 | 7  | 6  | 7  | 8  | 2   | 1  |
|                  | Spelling              | 9  | 10 | 6  | 6  | 8  | 7  | 2   | 1  |
|                  | Total                 | 47 | 47 | 31 | 34 | 38 | 41 | 14  | 13 |
| Line<br>Length   | Reading Comprehension | 8  | 9  | 7  | 7  | 5  | 9  | 3   | 6  |
|                  | Reading Comprehension | 9  | 10 | 6  | 7  | 8  | 10 | 1   | 5  |
|                  | \$ Word Problems      | 8  | 6  | 2  | 7  | 6  | 5  | 1   | 3  |
|                  | # Word Problems       | 9  | 9  | 7  | 8  | 8  | 9  | 4   | 4  |
|                  | Reading Comp. - Not   | 8  | 9  | 3  | 7  | 3  | 7  | 1   | 3  |
|                  | Total                 | 42 | 43 | 25 | 36 | 30 | 40 | 10  | 21 |
| Hierarchy        | + Vertical            | 8  | 10 | 10 | 10 | 9  | 10 | 4   | 0  |
|                  | + Horizontal          | 9  | 10 | 9  | 9  | 9  | 9  | 0   | 2  |
|                  | - Vertical            | 9  | 7  | 6  | 3  | 7  | 4  | 0   | 3  |
|                  | - Horizontal          | 9  | 10 | 7  | 7  | 8  | 7  | 1   | 1  |
|                  | Total                 | 35 | 37 | 32 | 29 | 33 | 30 | 5   | 6  |

the standard test for 80 percent of the individual subskill sections. An analysis of these differences indicated a number of instances (i.e., 32 percent) when mastery was achieved on the modified test but not the standard. Further analysis also indicated that specific test modifications produced substantial differences in numbers of students attaining mastery criteria by category. These differences were seen for LD, EH, and EMR students using unjustified line lengths, LD and EH students using boldface type, and EMR students using examples.

## CHAPTER V

### DISCUSSION AND CONCLUSIONS

Tests can be useful tools. If adequately designed and used properly, they can direct teachers to the specific strengths and weaknesses of any child. Tests can be used to determine degrees of deficits, facilitate appropriate placement, and be of assistance in the development of instructional strategies. The information obtained from tests is also useful in evaluating skills, planning lessons and curriculum, and determining amounts of progress that have been made. In essence, tests can be used to constructively analyze problems and serve as a basis for remediation.

Unfortunately, tests are not always designed and implemented sensibly or in the best interest of the child. Often test items do not measure what they purport to measure and a child's true ability is not adequately assessed. Although a child may cognitively know a skill, the manner in which the skill is tested may frequently affect his ability to demonstrate proficiency. The same skill presented in a different manner/mode may elicit a totally different response. Possibly, the greatest inequities of testing may be occurring with the handicapped population at the elementary level.

Salvia and Ysseldyke (1978) denote the fact that test items often measure the student's ability to "receive a stimulus and then

express a response" (p. 25). As a result, handicapped students may possibly be unable to demonstrate their true level of content knowledge; instead, their responses may be a measure of their ability to decode the directions, read all the words in the passage, and transfer answers. Gearheart and Willenberg (1974) emphasize the need for testing examiners to be aware of any confounding factors inherent to some handicapping conditions. They stress the need to "remember the primary handicap and make certain you are testing what you intend to test, not the reflection or outcome of the disability" (p. 85). Individuals involved in the design and administration of tests must be extremely careful to recognize the possible interaction between the student's ability, his disability, and the behavior sampled by the test items.

Consideration of appropriate test modification appears warranted. Salvia and Ysseldyke (1978) state that "common sense tells us that if a student cannot read the directions or write the responses, a test requiring these abilities is inappropriate" (p. 26). In support of this issue, Marsh, Gearheart, and Gearheart (1978) contend that students with poor reading and writing skills should not have to take tests under traditional circumstances. Tests need not be eliminated. As such, standard test forms may simply need to be modified according to individual differences. Optimally, tests could be designed for the handicapped population to adequately assess their skills and understanding of particular concepts. Variations in test design could compensate for visual-motor problems, auditory memory

deficiencies, or poor decoding skills. When a test compensates for these weaknesses, there is a greater assurance that the child's true ability has been accurately measured. Diagnosticians and educators can then proceed to take full advantage of the benefits that testing has to offer.

There has been little research associated with physical test modifications. Further, investigations appear to be warranted for those modifications that are specifically designed for the mild educationally handicapped (LD, EH, EMR) student (Salvia & Ysseldyke, 1978). Any information gathered, relative to the effects of test modifications, can serve as a basis for all future planning relative to designing and implementing tests of minimum abilities for handicapped students.

### Discussion of Findings

Eighty third grade students (normal, LD, EH, and EMR) from Alachua and Orange Counties were administered one of two versions of a minimum competency test. One group of 40 students, comprised of 10 students from each category, received the standard test. The other group of 40 students was administered a modified version of the standard test. Although the content of the test item remained constant, the physical formatting was altered by examples, boldface print, answer bubble placement, hierarchial arrangement, and line length.

### Test Form Analyses

Results of a statistical analysis using ANOVA indicated that although students consistently performed better on the modified test,

significant main effects for test form existed only for total test scores and those for the example subtest. On the average, students taking the modified test performed approximately six points higher on the 100 item test than those students taking the standard version. On the example subtest, students achieved higher scores (approximately two points or a gain of 10 percent) on the modified version than on the standard test. These findings would suggest that students' performance varies with the type of test administered, in favor of the modified version.

#### Category Analyses

Significant main effects for category of student were further evaluated using Tukey's Honestly Significant Differences procedure. Consistent for all tests (total and subtests) was similar performance between EH and LD students and between normal and EH students. On two subtests (those modified by hierarchical arrangement of items and unjustified line lengths) LD and normal students performed similarly. In all other instances, EMR and LD students performed significantly lower than other categories of students. These results support differences in student performance consistent with assigned category.

#### Post Hoc Analyses

Additional analyses were completed to address the specific effects of the test modifications relative to individual groups of

students. Although the overall analysis indicated that differences between these test scores were not significant at the  $\alpha = .05$  level, the issue of mastery of individual subskills was of interest.

The percentage of items correct for each subskill on both test versions was calculated. These scores were then compared with the current state mastery criteria. This comparison revealed that the performance scores on the modified test were higher than those on the standard test for 80 percent (20/25) of the subskills tested. The increase between mean scores ranged from 1 to 16 percentage points. These increases in performance scores for the modified test subsequently became the difference between mastery and failure for 32 percent (8/25) of the subskill sections. Students taking the modified test achieved mastery level criteria for one-third of the subskills that were not mastered on the standard version. This analysis also revealed that specific modifications appeared to facilitate acquisition of mastery by certain categories of handicapped students. Frequency of mastery was substantially higher for LD, EH, EMR students on the unjustified line length subtest, LD and EH students on the boldface type subtest, and EMR students on the example subtest.

Another issue of interest was the presence of any trend in performance scores between categories on total test. Some professionals may argue that physical format modifications may simply raise the test scores across all categories. Results of the post hoc analysis indicated that this was apparently not true in this study. While the differences between mean performance scores

for normal students was 3.6 (in favor of the modified test) the differences between standard and modified test scores for LD, EH, and EMR students were 6.8-7.6. These differences on the modified test were consistently three to four points higher for mildly handicapped students than they were for normal students.

Although no interaction between test form and category resulted from analysis of the inferential statistics, data were then analyzed to ascertain if specific categories obtained higher performance scores on any particular subtests for either test version. Emotionally handicapped students consistently scored an average of two points (10 percent) higher on the modified subtests for examples, boldface type, and answer bubble placement. Learning disabled students achieved an average of two points higher on the boldface type subtest and three points (15 percent) higher on the unjustified line length subtest, both modified versions. Normal and educable mentally retarded students' average scores did not appear to be affected by subtest modifications. One exception to this was EMR mean scores on the example subtest. In this one instance the differences between mean scores reached statistical significance, a difference of 20 percent.

### Observations

Several observations were made regarding certain irregularities in children's performances and any behaviors that occurred frequently.

For example, it became apparent early in the pilot study that test performance was closely related to reading ability. Those students who read well performed well, and those students who had poor reading skills had great difficulty taking the test and achieved low test scores. Another effect reading ability appeared to have on test performance was the ability of some children to understand passages read silently. Several mildly handicapped children appeared to demonstrate comprehension problems when reading to themselves and less confusion when reading aloud.

Many mildly handicapped students also appeared to be lacking in test taking skills. They did not recognize such basic direction words as "above," "below," "same," "different," "find," or "choose." Some students went directly from the reading passage to the test answer choices without reading the question of interest. Two groups of LD students, however, demonstrated outstanding test taking skills in reading. They read the question to be answered first and then continued to find the solution in the passage. For example, in response to "How did the story end?" these students immediately went to the last sentence (without reading the entire passage) and marked the corresponding answer.

Some students also demonstrated particular difficulties with the subskill of following directions. There was a tendency for a great many to follow the alphabet sequence of labeled dots rather than following the written sequence of directions. Frequently students would also read the directions completely and then declare "I don't know what I'm supposed to do." After the test was completed, several

children were taken aside and asked to redo 3-5 items from this section. In each instance the child read the problem aloud. At the end of each sentence that included a directional clue, the examiners said, "Do it!" The confusion was all but eliminated and the students performed with little difficulty.

Another consistent problem for students was those test items measuring the child's ability to locate two particular items out of four and then correctly mark only one of those two. For example, "Look at these pictures. Find the apple. Find the other thing that is good to eat. Mark the one you found last." "Find the animals. Mark the large animal." Many children consistently marked two answers for each question, both things to eat and both animals.

Two final observations are noted. It appeared that for some children the best method for obtaining an accurate assessment of ability would only be in a one to one test situation. Independent test performance scores obtained within a group did not seem equivalent to those that could be obtained on a one to one, examiner to student, basis. Finally, there were those students who did not pay attention to the test item numbers. Instead of progressing vertically down each side of the page as the test was numbered, most children proceeded to answer the items presented horizontally across the top of each page and then across the bottom. One curriculum resource teacher noted, "It makes me so angry. The minimum competency tests are laid out in a different order than the Ginn reading workbooks and tests. The kids frequently get so confused." This confusion results from reading one passage (upper left quadrant) and

answering questions to another passage (upper right quadrant). This posed potential problems in this study along with affecting the math hierarchy. It was corrected by repeatedly demonstrating the correct order to each student individually and monitoring activity closely.

### Implications

In an instance when mastery criteria are of utmost importance, it appears that the modifications made in this study, alterations in physical formatting, have some merit. Students taking the modified test achieved mastery level criteria in eight of 25 sub-skills that were not mastered on the standard version. Mastery achievement on the modified subtests may contribute to the self-concept and positive attitude of the mildly handicapped learner and possibly facilitate his acquisition of a standard diploma in some states.

As indicated in the post hoc analysis of EMR students' performance on the example subtest, these students may indeed know how to perform a skill but demonstrate proficiency more readily when examples are provided. The test scores of emotionally handicapped students also appeared to be affected (10% gain) by the inclusion of examples.

Learning Disabled and emotionally handicapped students' scores improved 10% with the use of boldface type. Other students however did not appear to benefit from the additional attention created by boldface type. Basically students who know such clue words as who,

what, where, not, end, first, last apparently do require any additional emphasis to aid in comprehension.

Learning disabled students appeared to benefit (10% gain) from alterations in line length. Other students performed similarly on passages set in justified and unjustified manner.

It appears that the order of item presentation does not make a difference in the performance of any category of student. If the student is proficient with a task, he appears to be able to demonstrate his ability regardless of placement within the test. Similarly, answer bubble placement does not appear to affect performance of any type of student.

As a result of observations made throughout the study, it appears that teachers may wish to give consideration to the importance of test taking skills. The performance of mildly handicapped students may be enhanced from direct instruction of such skills as recognizing basic direction words (above, different, choose, other), learning how to follow written directions, and using short cuts for answering reading comprehension questions. Teachers may also wish to familiarize students with the physical layout of the test.

### Conclusions

There was a significant difference between modified and standard tests on the total test scores and for the example subtest in favor of the modified test. Emotionally handicapped and LD students performed most similarly in all instances, as did normal and EH students. Educable mentally retarded students consistently performed lower than any other category. There were no interactions

present between category of student and test form. As can be seen from data presented in Appendix E, it was not possible to determine significance of either sex or race on test scores due to the limited sample size.

Results of post hoc analysis however indicated that the modifications would be beneficial in instances where mastery was an issue. Students needing to demonstrate mastery of a skill could do so on 32 percent more sections within the modified test than on the standard test. Gains of 1-16 percentage points could be seen on 80 percent of the subskills tested with the modified test in contrast to the standard test. Also, certain modifications appeared to facilitate acquisition of mastery by specific categories of handicapped students.

Modifications in physical formatting do not appear to improve test scores across all categories. The inclusion of examples appears to facilitate the demonstration of proficiency for EMR students only. Scores for hierarchical arrangement of items, answer bubble placement, unjustified line lengths, and boldface type did not reach levels of significance. Trends for higher test scores (10-15% gains) were noticed however in the use of examples and boldface type for emotionally disturbed students and with boldface type and unjustified line lengths for learning disabled students. Due to the limited amount of research that has been previously done, and because the results of this study have been favorable, further research on this topic appears justified.

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## APPENDIX A

### ELIGIBILITY CRITERIA

#### Specific Learning Disabilities

Specific learning disabilities—one who exhibits a disorder in one or more of the basic psychological processes involved in understanding or in using spoken and written language. These may be manifested in disorders of listening, thinking, reading, talking, writing, spelling, or arithmetic. They do not include learning problems which are due primarily to visual, hearing, or motor handicaps, to mental retardation, emotional disturbance, or to an environmental deprivation.

#### 1. Criteria for Eligibility

- a. The student must be of school age.
- b. Evidence of a disorder in one or more of the basic psychological processes.

(1) Based on a student's expected level of functioning a score of two standard deviations or less below the mean in one process area or a score of one and one-half standard deviations or less below the mean in three or more process areas. Process areas are defined as: visual channel processes, auditory channel processes, haptic channel processes, language

processes, and sensory integrated processes. In cases where the standard deviation is not available, a score of 70 percent or less of the student's expectancy age in one process area of 80 percent or less in three or more process areas may be used.

- (2) Evidence of a process strength at or above the student's expected level of functioning.
- (3) If more than one process test instrument is used to document a deficit or strength, the results must consistently show deficits or strengths in the same process area. If more than one level of functioning is obtained, the mean level of functioning will be used to establish a deficit or strength.
- (4) Only subtests appropriate for the student's expectancy age should be used for placement purposes.
- (5) A student does not qualify for eligibility if the following subtests are the only ones that indicate a process strength or deficit.

(a) Detroit Test of Learning Abilities

Free Association  
Social Adjustment A  
Social Adjustment B  
Number Ability

(b) Illinois Test of Psycholinguistic Abilities

Manual Expression  
Grammatical Closure  
Sound Blending

In order for these subtests to be considered, they must be viewed in conjunction with other subtests.

c. Evidence of academic deficits.

- (1) Based on the student's expected level of functioning, a score of: 85 percent expectancy age or below for third through sixth grade; 75 percent expectancy age or below for seventh through ninth grade; or 65 percent expectancy age or below for tenth through twelfth grade is required in one or more of the following academic areas: reading, writing, arithmetic, or spelling. For students in kindergarten and first grade, evidence must be presented that achievement is 95 percent expectancy age or below on preacademic tasks which require listening, thinking, or speaking skills. For students in second grade, evidence must be presented that achievement is 90 percent expectancy age or below on preacademic tasks which require listening, thinking, or speaking skills. A student may not be placed for a deficit in either writing or spelling or both.
- (2) If more than one academic instrument is used to document a weakness, the results must consistently show deficits in the same academic area. If more than one level of functioning is obtained, the mean level of functioning will be used to establish weakness.

d. Evidence that learning problems are not due primarily to other handicapping conditions.

- (1) A score of not less than two standard deviations below the mean on an individual test of intellectual functioning

or evidence indicator of the student's intellectual potential.

- (2) For students with visual processing deficits, visual acuity of at least 20/70 in the better eye with best possible correction or evidence that the student's inability to perform adequately on tasks which require visual processing is not due to poor visual acuity.
  - (3) For students with auditory processing or language deficits, auditory acuity of not more than a 30 decibel loss in the better ear unaided or evidence that the student's inability to perform adequately on tasks which require auditory processing or language is due to poor auditory acuity.
  - (4) For student with a motor handicap, evidence that the inability to perform adequately on tasks which assess the basic psychological processes is not due to the motor handicap.
  - (5) For students who exhibit persistent and consistent severe emotional disturbance evidence that their inability to perform adequately on tasks which assess the basic psychological processes is not due to the emotional disturbance.
- e. Documented evidence which indicates that viable general educational alternatives have been attempted and found to be ineffective in meeting the student's educational needs.

### Educable Mentally Retarded

Educable mentally retarded—one who is mildly impaired in intellectual and adaptive behavior and whose development reflects a reduced rate of learning. The measured intelligence of an educable mentally retarded student generally falls between two (2) and three (3) standard deviations below the mean, and the assessed adaptive behavior falls below age and cultural expectations.

#### 1. Criteria for Eligibility

- a. The measured level of intellectual functioning, as determined by performance on an individual test of intelligence, is between two (2) and three (3) standard deviations below the mean. The standard error of measurement may be considered in individual cases. The profile of intellectual functioning shows consistent sub-average performance in a majority of areas evaluated.
- b. The assessed level of adaptive behavior is below age and cultural expectations.
- c. Sub-average performance on a standardized measure of academic achievement is demonstrated.

### Emotionally Handicapped

Emotionally handicapped—one who after receiving supportive educational assistance and counseling services available to all students, still exhibits a persistent and consistent severe emotional handicap which consequently disrupts the student's own learning process. This is the student whose inability to achieve adequate

academic progress or satisfactory interpersonal relationships cannot be attributed primarily to physical, sensory, or intellectual deficits.

1. Criteria for Eligibility

- a. Evidence that the student has received supportive educational assistance counseling.
- b. Evidence that the student exhibits a persistent and consistent severe emotional handicap as determined by documented observations and psychological evaluation.
- c. Evidence that the behavior disrupts the student's ability to achieve adequate academic progress or develop satisfactory interpersonal relationships.
- d. Evidence that the primary problem of the student cannot be attributed primarily to physical, sensory, or intellectual deficits.

APPENDIX B  
PARENT PERMISSION SLIPS

Dear Parent,

I am currently a doctoral candidate in the Department of Special Education at the University of Florida. I am in the process of conducting a study to find out if differences in the way test questions are worded, placed, or marked will affect how third grade students do on the test.

Children in this study will be asked to take a 100 item test, which should take about 90 minutes. The test will be much like the State Student Assessment Test which third graders in Florida take each October. The test scores will remain confidential and will not be recorded in any of the students' permanent records. The scores merely will be used to compare the achievement of different groups, based on individual test changes.

The study will be conducted under the supervision of Special Education staff members of the Orange County Public Schools.

I would be most willing to answer any questions you may have regarding the goals or procedures of this study. If you agree to allow your child to participate in this study, please sign and date this form. You can always withdraw your consent for your child's participation at any time without prejudice.

Please have your child return this form to school as soon as possible. Thank you for your time and consideration.

Sincerely,

Susan Beattie

\*\*\*\*\*

Parent of \_\_\_\_\_  
(child's name)

Parent signature \_\_\_\_\_ Date \_\_\_\_\_

Dear Parent,

I am currently a doctoral candidate in the Department of Special Education at the University of Florida. I am in the process of conducting a study regarding the effect of physical test item modifications on the performance of third grade students. This form is asking parents for their written consent to have their son or daughter participate in the study.

The study will be conducted within the Alachua County School System. We will be asking each child to take a 100 item test, which should take approximately 90 minutes. There will be two tests utilized; a standard form and a modified version. There are no discomforts or risks anticipated for any of the students. Additionally, there will be no monetary compensation offered. The test scores obtained in this study will remain confidential and will not be recorded in any of the student's permanent records. The scores will be merely used to compare the achievement of different groups, based on individual test modifications.

As educators, we are continually striving to discover the most appropriate way of assessing individual children's cognitive abilities. It is hoped that the results of this study will provide valuable information regarding the test taking abilities of elementary aged children under different circumstances.

I would be most willing to answer any questions you may have regarding the goals or procedures of this effort. If you agree to

allow your child to participate in this study, please sign and date this form. There will always be the option available to withdraw your consent for your child's participation in this study at any time without prejudice. Thank you for your time and consideration.

Sincerely,

Susan Beattie

\*\*\*\*\*

Signatures:

|         |       |         |       |
|---------|-------|---------|-------|
| _____   | _____ | _____   | _____ |
| Subject | Date  | Witness | Date  |

|                                       |       |                                              |       |
|---------------------------------------|-------|----------------------------------------------|-------|
| _____                                 | _____ | _____                                        | _____ |
| Relationship if other than<br>subject | Date  | Principal Investigator's<br>name and address | Date  |

APPENDIX C  
SAMPLE TEST—STANDARD

DIRECTIONS: The list of words in each box is in alphabetical order. (Remember, that means A,B,C order.) Choose the word to go in the blank that will keep each list in alphabetical order.

- 14.
- |           |                             |
|-----------|-----------------------------|
| 1. bag    |                             |
| 2. _____  | <input type="radio"/> part  |
| 3. orange | <input type="radio"/> under |
| 4. road   | <input type="radio"/> earth |
| 5. teach  | <input type="radio"/> rose  |

- 16.
- |           |                              |
|-----------|------------------------------|
| 1. absent |                              |
| 2. donkey | <input type="radio"/> ear    |
| 3. goal   | <input type="radio"/> light  |
| 4. _____  | <input type="radio"/> depart |
| 5. next   | <input type="radio"/> park   |

- 15.
- |           |                            |
|-----------|----------------------------|
| 1. letter |                            |
| 2. new    | <input type="radio"/> snow |
| 3. _____  | <input type="radio"/> corn |
| 4. wide   | <input type="radio"/> king |
| 5. zebra  | <input type="radio"/> dead |

- 17.
- |          |                             |
|----------|-----------------------------|
| 1. giant |                             |
| 2. _____ | <input type="radio"/> brain |
| 3. nest  | <input type="radio"/> ruler |
| 4. shirt | <input type="radio"/> field |
| 5. vest  | <input type="radio"/> heart |

DIRECTIONS: Read the story in each box. Choose the best answer for each question.

The bee bit the puppy on his nose. The puppy ran to the dish of water. He put his nose in the water.

29. Who bit the puppy?

- ☐ the man
- ☐ the cat
- ☐ the bee
- ☐ the dog

30. Where did the puppy run?

- ☐ to his mother
- ☐ to his dish of water
- ☐ to the lake
- ☐ to a tree

In the Fall, witches fly through the sky on brooms. Once a witch bumped into a cloud. Her broom broke and she fell to the ground.

31. What did the witch do?

- ☐ bump into a cloud
- ☐ sing a song
- ☐ scare people
- ☐ win the race

32. When do witches fly in the sky?

- ☐ in the clouds
- ☐ in the Fall
- ☐ on a broom
- ☐ over the moon

DIRECTIONS: Read these problems.  
Figure out the right answer.

45. There were 33 boys and 22 girls at a lake swimming. How many children were swimming together?

☐ 64 children  
☐ 55 children  
☐ 11 children  
☐ 10 children

47. Jennifer won 24 games. Tom won 35 games. How many games did they win in all?

☐ 11 games  
☐ 51 games  
☐ 14 games  
☐ 59 games

46. The library had 76 books. The library bought 22 more books. How many books are in the library now?

☐ 98 books  
☐ 17 books  
☐ 54 books  
☐ 58 books

48. Sally made 32 cookies. Fred made 15 cookies. How many cookies did Sally and Fred make altogether?

☐ 61 cookies  
☐ 47 cookies  
☐ 23 cookies  
☐ 11 cookies

61. Subtract:  $\begin{array}{r} 47 \\ - 20 \\ \hline \end{array}$

- ☐ 49
- ☐ 27
- ☐ 13
- ☐ 23

64. Subtract:  $\begin{array}{r} 66 \\ - 3 \\ \hline \end{array}$

- ☐ 68
- ☐ 15
- ☐ 51
- ☐ 63

62. Subtract:  $78 - 3 =$

- ☐ 75
- ☐ 12
- ☐ 18
- ☐ 73

65. Subtract:  $58 - 24 =$

- ☐ 7
- ☐ 19
- ☐ 34
- ☐ 82

63. Subtract:  $13 - 7 =$

- ☐ 4
- ☐ 6
- ☐ 11
- ☐ 20

66. Subtract:  $\begin{array}{r} 14 \\ - 5 \\ \hline \end{array}$

- ☐ 9
- ☐ 11
- ☐ 46
- ☐ 19

DIRECTIONS: Read the story and answer the question.

93. Bob and Jim were on the same football team. Bob scored 21 points. Jim scored 7 points. Altogether, how many points did Bob and Jim score?

☐ 10 points  
☐ 28 points  
☐ 26 points  
☐ 17 points

95. There are 15 boys in Miss Smith's class. There are also 13 girls in the class. How many children are in the class altogether?

☐ 28 children  
☐ 10 children  
☐ 2 children  
☐ 46 children

94. John caught 32 fish. Mike caught 24 fish. How many fish did they catch in all?

☐ 74 fish  
☐ 56 fish  
☐ 8 fish  
☐ 11 fish

96. Sally went on a trip and drove 56 miles. Her husband drove 33 miles. How many miles did Sally and her husband drive altogether?

☐ 23 miles  
☐ 90 miles  
☐ 17 miles  
☐ 89 miles

APPENDIX D  
SAMPLE TEST—MODIFIED

DIRECTIONS: The list of words in each box is in alphabetical order. (Remember, that means A,B,C order.) Choose the word to go in the blank that will keep each list in alphabetical order.

| EXAMPLE   |                                |
|-----------|--------------------------------|
| 1. dog    | <input type="checkbox"/> zoo   |
| 2. fight  | <input type="checkbox"/> apple |
| 3. _____  | <input type="checkbox"/> cow   |
| 4. paper  | <input type="checkbox"/> man   |
| 5. street |                                |

- 14.
- |           |                                |
|-----------|--------------------------------|
| 1. bag    | <input type="checkbox"/> part  |
| 2. _____  | <input type="checkbox"/> under |
| 3. orange | <input type="checkbox"/> earth |
| 4. road   | <input type="checkbox"/> rose  |
| 5. teach  |                                |

- 16.
- |           |                                 |
|-----------|---------------------------------|
| 1. absent | <input type="checkbox"/> ear    |
| 2. donkey | <input type="checkbox"/> light  |
| 3. goal   | <input type="checkbox"/> depart |
| 4. _____  | <input type="checkbox"/> park   |
| 5. next   |                                 |

- 15.
- |           |                               |
|-----------|-------------------------------|
| 1. letter | <input type="checkbox"/> snow |
| 2. new    | <input type="checkbox"/> corn |
| 3. _____  | <input type="checkbox"/> king |
| 4. wide   | <input type="checkbox"/> dead |
| 5. zebra  |                               |

- 17.
- |          |                                |
|----------|--------------------------------|
| 1. giant | <input type="checkbox"/> brain |
| 2. _____ | <input type="checkbox"/> ruler |
| 3. nest  | <input type="checkbox"/> field |
| 4. shirt | <input type="checkbox"/> heart |
| 5. vest  |                                |

DIRECTIONS: Read the story in each box. Choose the best answer for each question.

The bee bit the puppy on his nose. The puppy ran to the dish of water. He put his nose in the water.

29. **Who** bit the puppy?

- ☐ the man
- ☐ the cat
- ☐ the bee
- ☐ the dog

30. **Where** did the puppy run?

- ☐ to his mother
- ☐ to his dish of water
- ☐ to the lake
- ☐ to a tree

In the Fall, witches fly through the sky on brooms. Once a witch bumped into a cloud. Her broom broke and she fell to the ground.

31. **What** did the witch do?

- ☐ bump into a cloud
- ☐ sing a song
- ☐ scare people
- ☐ win the race

32. **When** do witches fly in the sky?

- ☐ in the clouds
- ☐ in the Fall
- ☐ on a broom
- ☐ over the moon

DIRECTIONS: Read these problems.  
Figure out the right answer.

45. There were 33 boys and 22 girls at a lake swimming. How many children were swimming together?

64 children ☐  
55 children ☐  
11 children ☐  
10 children ☐

47. Jennifer won 24 games. Tom won 35 games. How many games did they win in all?

11 games ☐  
51 games ☐  
14 games ☐  
59 games ☐

46. The library had 76 books. The library bought 22 more books. How many books are in the library now?

98 books ☐  
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48. Sally made 32 cookies. Fred made 15 cookies. How many cookies did Sally and Fred make altogether?

61 cookies ☐  
47 cookies ☐  
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11 cookies ☐

76. Subtract:  $13 - 7 =$

- ☐ 4
- ☐ 6
- ☐ 11
- ☐ 20

79. Subtract:  $58 - 24 =$

- ☐ 7
- ☐ 19
- ☐ 34
- ☐ 82

77. Subtract:  $27 - 4 =$

- ☐ 13
- ☐ 31
- ☐ 17
- ☐ 23

80. Subtract:  $89 - 51 =$

- ☐ 38
- ☐ 7
- ☐ 30
- ☐ 23

78. Subtract:  $78 - 3 =$

- ☐ 75
- ☐ 12
- ☐ 18
- ☐ 73

DIRECTIONS: Read the story and answer the question.

93. Bob and Jim were on the same football team.  
Bob scored 21 points.  
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Altogether, how many points did Bob and Jim score?

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Her husband drove 33 miles.  
How many miles did Sally and her husband drive altogether?

☐ 23 miles  
☐ 90 miles  
☐ 17 miles  
☐ 89 miles

# APPENDIX E

## MEAN PERFORMANCE SCORES BY CATEGORY, RACE, AND SEX

|        |   | (n) $\bar{x}$ Total Score |                | Example |      | Bulldface |      | (n) $\bar{x}$ Subtest Score |      | Hierarchy |      | Line Length |      |
|--------|---|---------------------------|----------------|---------|------|-----------|------|-----------------------------|------|-----------|------|-------------|------|
|        |   | Standard                  | Total Modified | Std.    | Mod. | Std.      | Mod. | Answer Bubble               | Std. | Mod.      | Std. | Mod.        | Mod. |
| Normal | B | (2) 90.5                  | (4) 92.5       | 19.0    | 18.7 | 17.0      | 18.7 | 18.0                        | 18.7 | 19.0      | 18.7 | 17.5        | 17.5 |
|        | W | (1) 79.0                  | (1) 94.0       | 14.0    | 20.0 | 15.0      | 20.0 | 16.0                        | 18.0 | 15.0      | 20.0 | 19.0        | 15.0 |
|        | B | (5) 91.4                  | (3) 89.6       | 18.0    | 18.0 | 18.6      | 17.3 | 19.0                        | 18.3 | 19.6      | 19.0 | 16.2        | 17.0 |
|        | W | (2) 88.0                  | (2) 98.0       | 19.5    | 19.5 | 17.5      | 19.0 | 19.0                        | 20.0 | 17.0      | 20.0 | 15.0        | 20.0 |
| LD     | B | (2) 63.5                  | (2) 65.0       | 16.0    | 16.0 | 9.5       | 10.0 | 12.5                        | 11.0 | 12.0      | 15.0 | 13.5        | 13.0 |
|        | W | (3) 69.6                  | (5) 81.6       | 14.7    | 17.0 | 14.6      | 16.0 | 11.3                        | 15.0 | 17.0      | 17.4 | 12.0        | 15.8 |
|        | B | (1) 76.0                  | (0) -          | 19.0    | -    | 16.0      | -    | 16.0                        | -    | 17.0      | -    | 8.0         | -    |
|        | W | (4) 75.7                  | (3) 81.6       | 15.0    | 14.3 | 14.2      | 17.6 | 15.5                        | 17.0 | 17.7      | 17.6 | 13.2        | 15.0 |
| EH     | B | (4) 65.7                  | (6) 81.0       | 13.0    | 16.0 | 12.2      | 16.3 | 14.5                        | 17.1 | 15.0      | 17.6 | 11.0        | 13.8 |
|        | W | (5) 88.0                  | (2) 79.0       | 17.6    | 17.0 | 18.4      | 13.5 | 17.2                        | 16.5 | 18.0      | 16.0 | 16.6        | 16.0 |
|        | B | (1) 60.0                  | (0) -          | 14.0    | -    | 8.0       | -    | 11.0                        | -    | 19.0      | -    | 10.0        | -    |
|        | W | (0) -                     | (2) 94.5       | -       | 19.5 | -         | 20.0 | -                           | 19.0 | -         | 19.0 | -           | 17.0 |
| EMR    | B | (2) 35.5                  | (5) 55.6       | 8.0     | 13.4 | 6.5       | 9.0  | 7.5                         | 4.4  | 8.0       | 14.8 | 5.5         | 9.6  |
|        | W | (4) 40.0                  | (1) 35.0       | 6.0     | 5.0  | 8.2       | 9.0  | 8.5                         | 0.0  | 9.7       | 3.0  | 7.5         | 6.0  |
|        | B | (2) 26.5                  | (1) 36.0       | 6.0     | 11.0 | 3.0       | 4.0  | 7.0                         | 0.0  | 7.5       | 5.0  | 13.0        | 5.0  |
|        | W | (2) 51.5                  | (3) 38.0       | 9.5     | 9.0  | 9.5       | 8.3  | 10.0                        | 3.2  | 13.0      | 9.6  | 5.5         | 5.6  |

## BIOGRAPHICAL SKETCH

Susan Beattie was born in Geneva, New York, on December 28, 1949. Upon completion of high school, she entered the State University College at Buffalo, New York. At the end of her junior year (1969), she went to Europe, studied at the University of Maryland (West Germany), and traveled extensively before returning in 1973. She completed her undergraduate program at State University College at Buffalo and in 1973 was awarded a B.S. degree in speech pathology and audiology. She then continued her studies at SUCB to receive an M.S.Ed. in communication disorders in 1975.

Susan worked at the Buffalo Hearing and Speech Center as a speech pathologist for four years. Her primary responsibilities were assessment and remediation of preschool handicapped populations and the hearing impaired.

She and her husband, John, moved to Gainesville, Florida, in 1977 to enable John to pursue an advanced degree in special education. For three years she was employed with the Alachua County School System as a learning disabilities teacher, speech therapist, and self-contained language clinician.

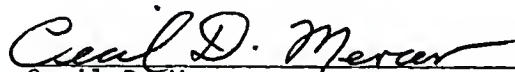
She enrolled at the University of Florida to pursue an advanced degree in learning disabilities. Her minor areas included early assessment and administration/supervision. She hopes to gain employment as an educational diagnostician in a children's hospital or special education administrator in a large urban school system.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.



Robert F. Algozzine, Chairman  
Professor of Special Education

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.



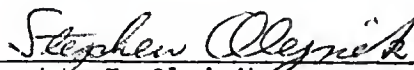
Cecil D. Mercer  
Professor of Special Education

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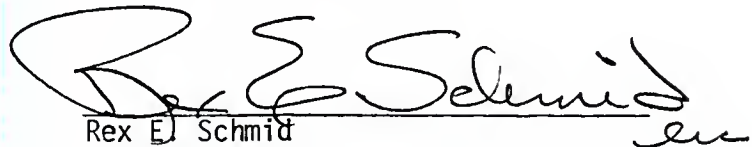
Catherine V. Morsink  
Professor of Special Education

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.



Stephen F. Olejnik  
Assistant Professor of Foundations  
of Education

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

  
Rex E. Schmid  
Associate Professor of Special  
Education

This dissertation was submitted to the Graduate Faculty of the Department of Special Education in the College of Education and to the Graduate Council, and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

August 1982

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Dean, Graduate School

